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V8 #94

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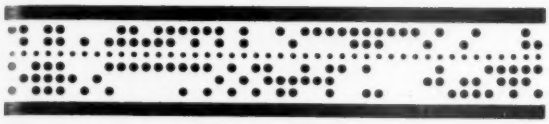

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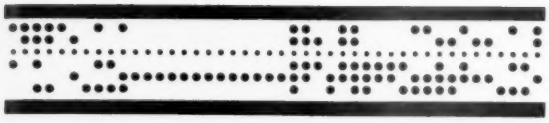

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Vol. 8, No. 94 **October 1954**

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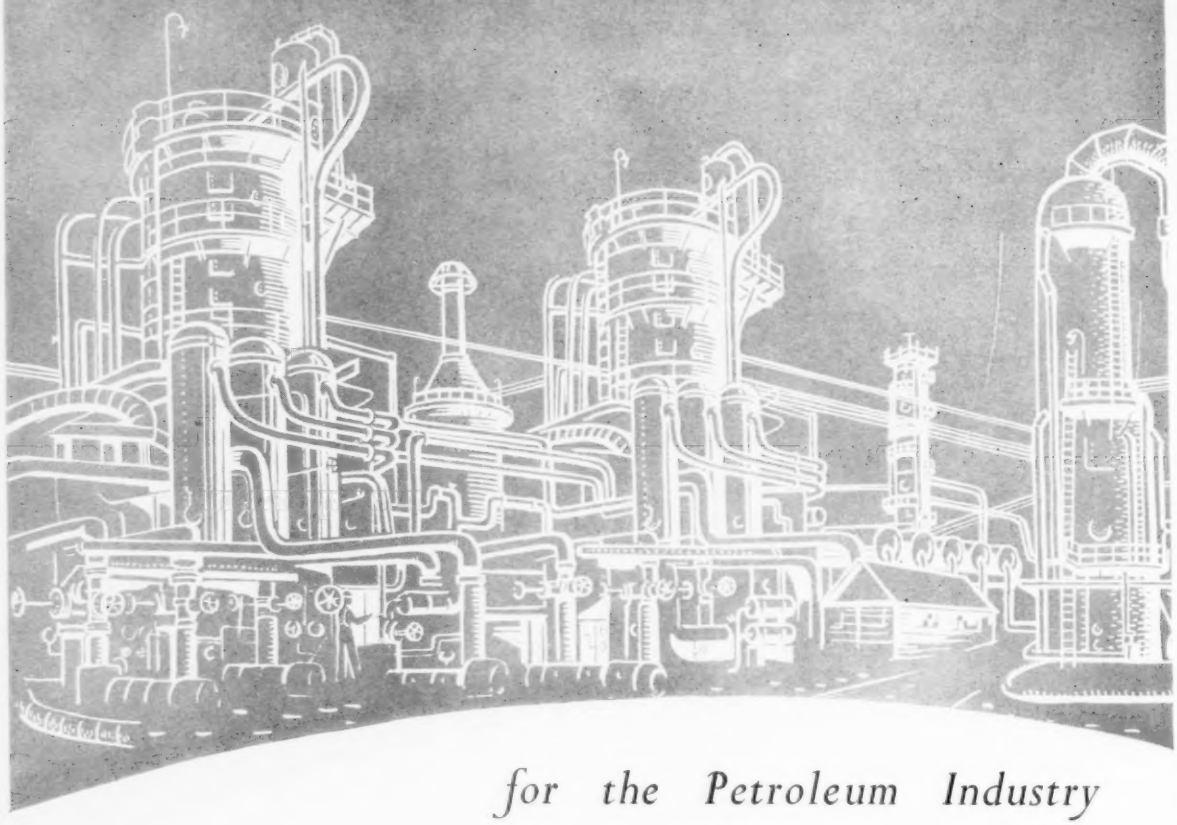

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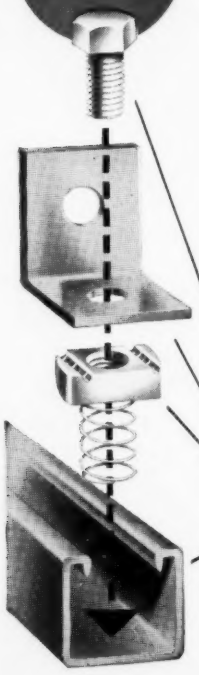

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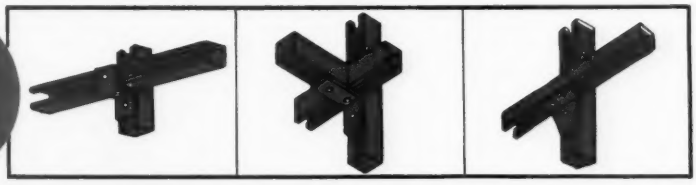

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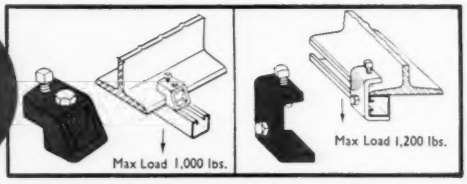

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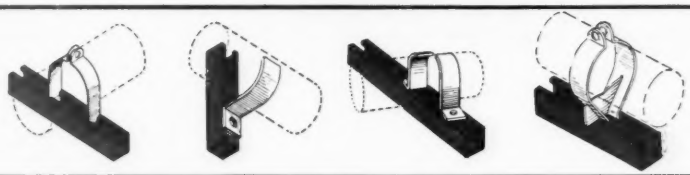

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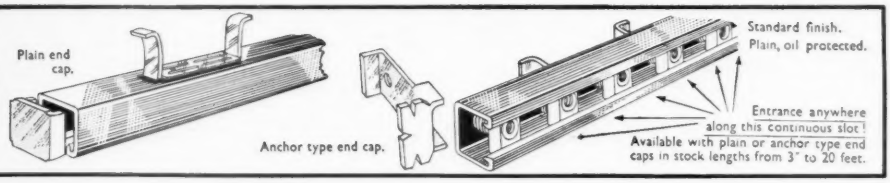
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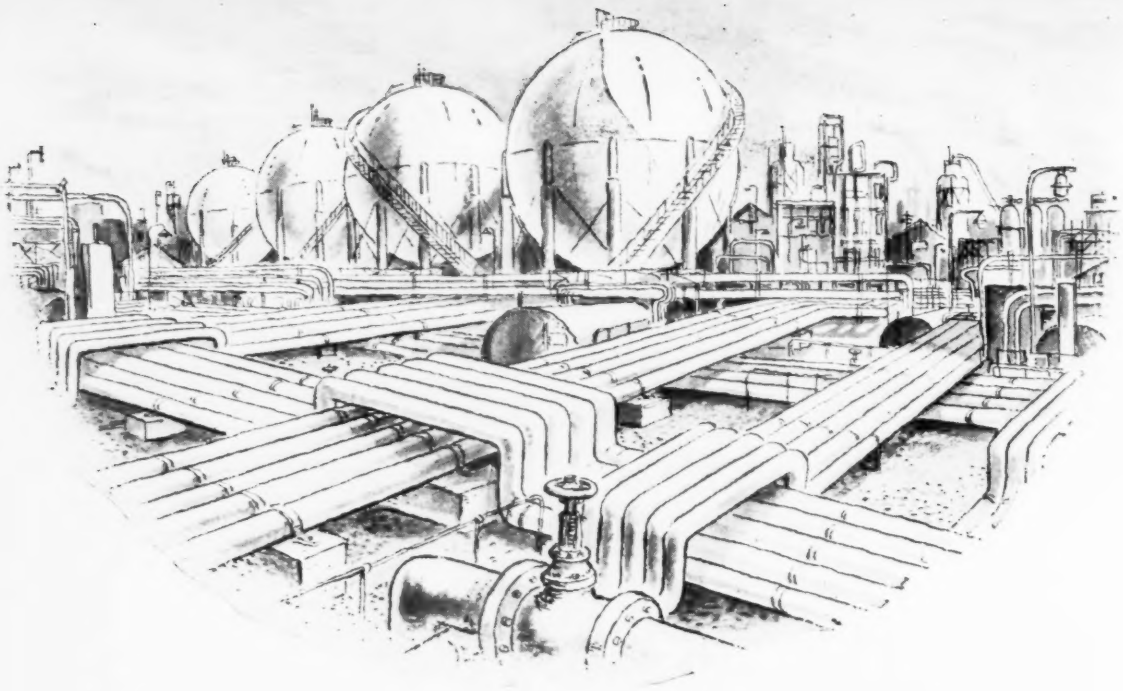

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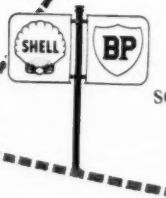

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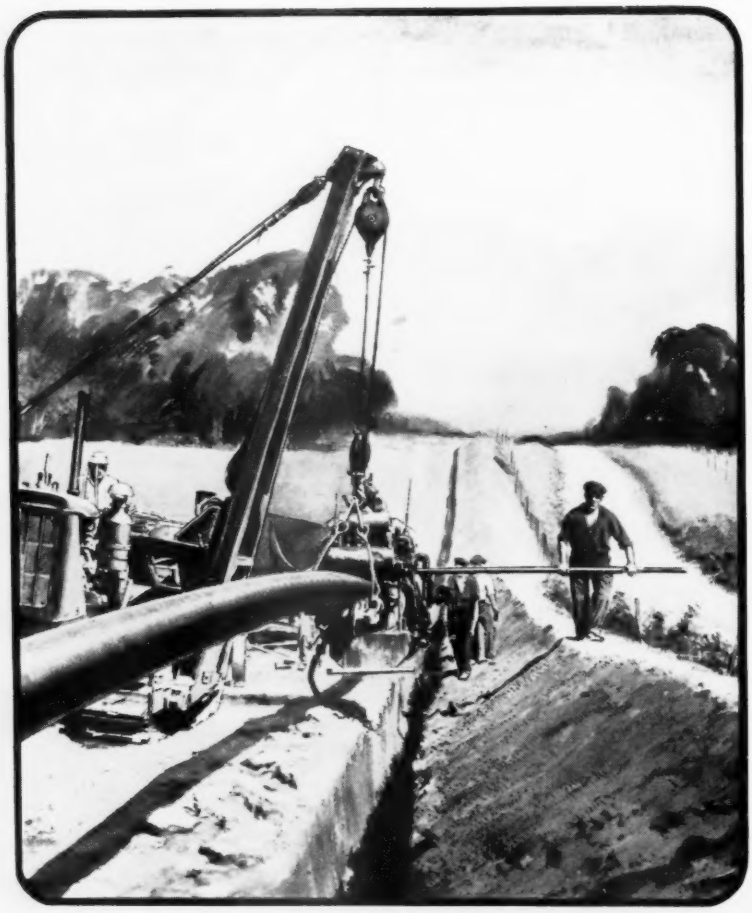

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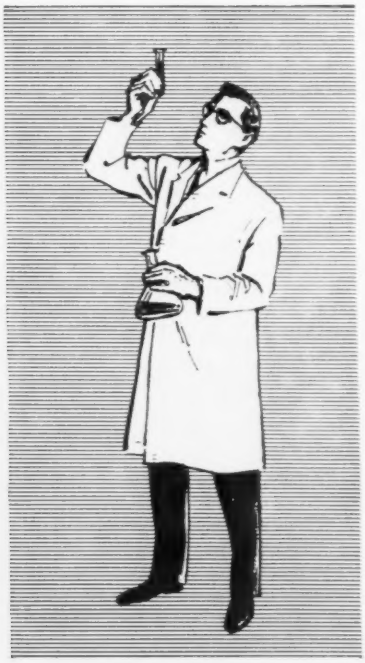

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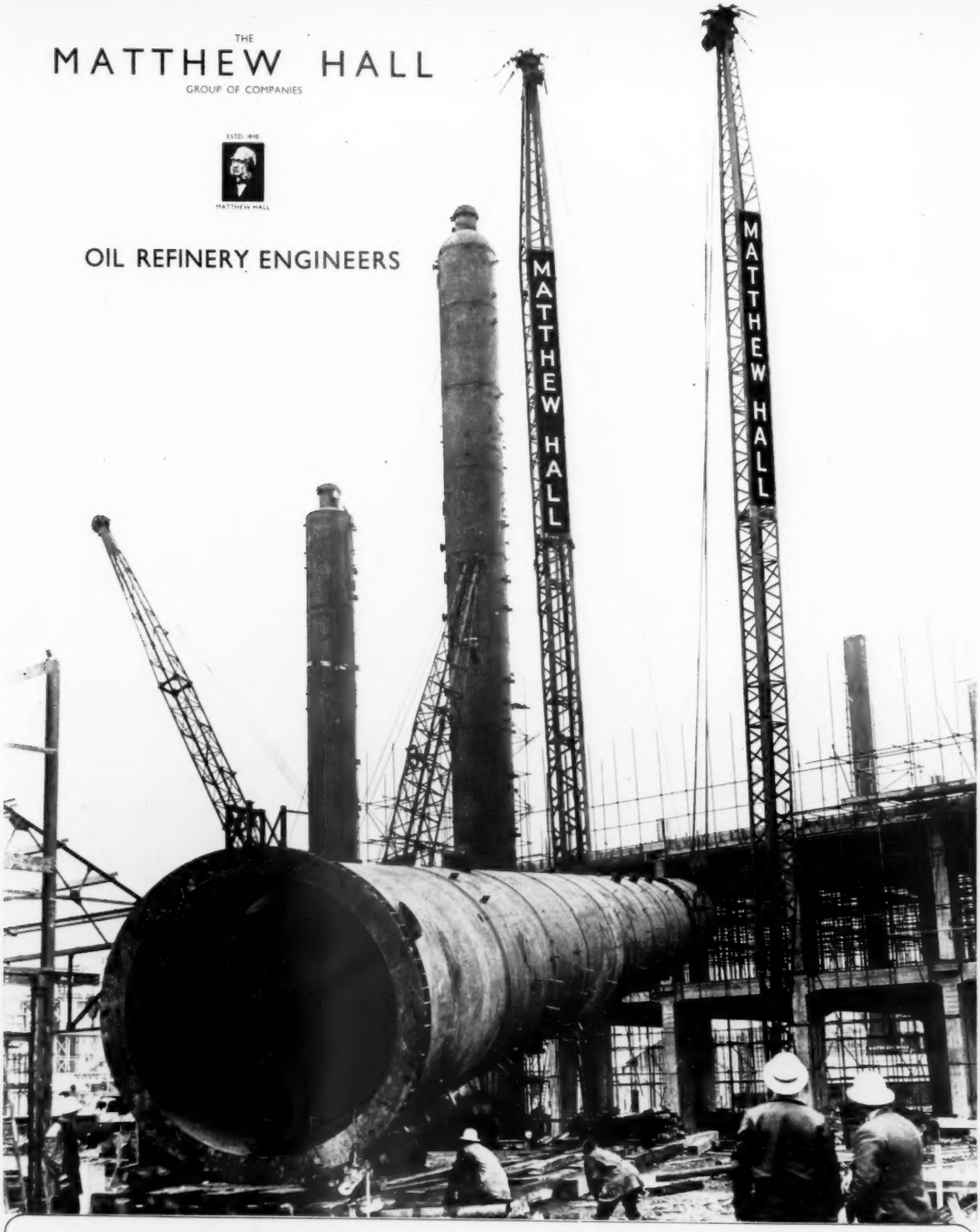

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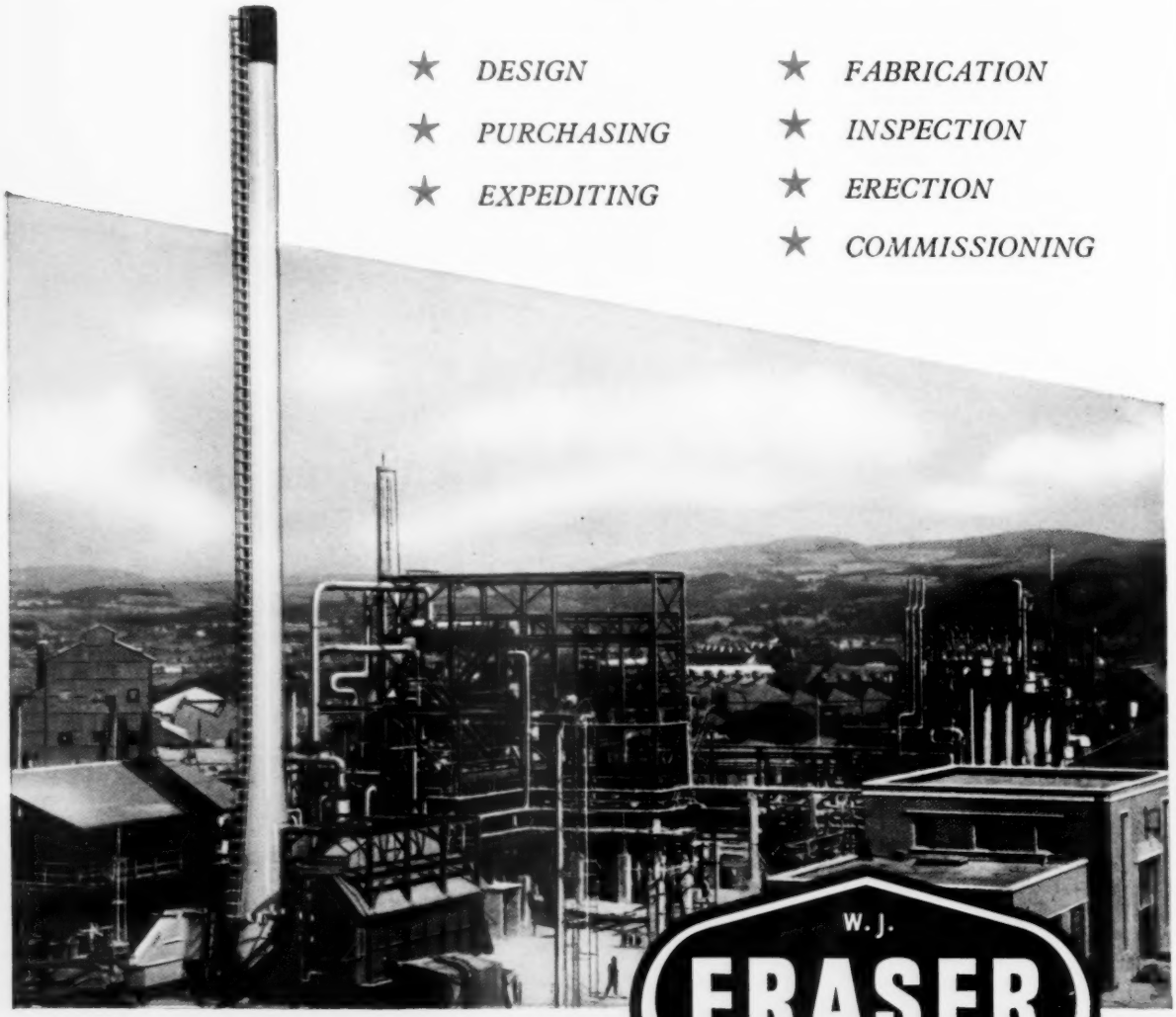

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Calibration of Tanks and Tankers*

PART I—GENERAL METHODS OF SHORE-TANK CALIBRATION

By **W. F. JELFFS and P. A. M. JELFFS†**

The subject with which this paper deals has so wide a range that its treatment must necessarily be confined to those types of receptacles most generally in use.

Calibration is really only a question of solid geometry involving the measurement of the cubic capacity of "chunks of space", of which the upper surfaces are horizontal, for given increments of height throughout the receptacle to be calibrated. The importance of accuracy in the preparation of calibration tables is obvious because any errors will have a far-reaching cumulative effect during the many years tables are in operation.

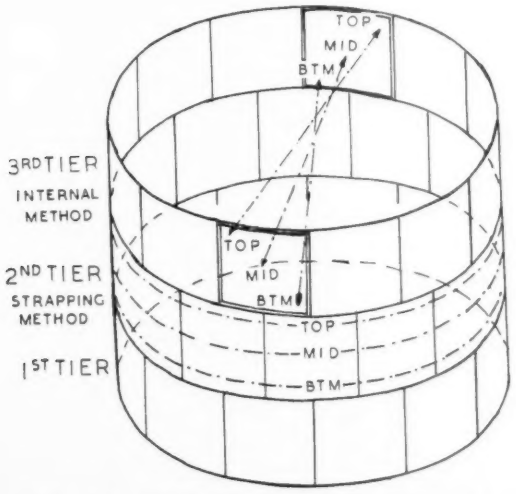

Fig 1. *Methods of measuring tanks for calibration.*

The purpose of calibration is to obtain a table which contains the figures necessary to determine the capacity of a tank at any given height. There are four methods employed to obtain the fundamental measurements from which the calibration scales are computed, namely, builders' plans; strapping; internal diameters; and water calibration.

Tanks

Builders' Plans

In this method the dimensions of the receptacle are taken from builders' plans and the calibration chart is endorsed to this effect. The method is generally used only when it is not possible to obtain field measurements, for example, in the case of underground or lagged tanks that could not conveniently be emptied, gas-freed, and cleaned.

Strapping Method

The tank should be calibrated after it has been subjected to a full water test.

As the description implies this method consists of measuring the outside circumferences of cylindrical tanks at various heights. Measurements of circumferences are shown on the second tier in Fig 1.

In the case of vertical tanks circumferences are measured by taking three strappings on each course or tier, one near the bottom, one at the middle, and one near the top. The positions for taking these measurements are described in the IP *Petroleum Measurement Manual*, pages 6 and 7.

The measurements are taken with a steel tape attached to a spring-balance and a tension of ten pounds is applied at the time each measurement is taken. The tension applied to the tape is transmitted throughout its length by means of a metal ring sliding on the tape.

The circumferential measurements have to be corrected in cases where the tape crosses over obstructions which cause it to deviate from a true circular path and a "step-over" is used to measure the correction to be applied. This is usually a rigid wooden frame with a steel scribing point at each end. The length of the tape path between the two points will, of course, vary with the tank diameter so the tape is stretched round a plate where no obstructions occur and the distance between the scribing points is measured. This measurement will represent the "step-over" interval for the particular tank being calibrated. This interval represents the actual length of the arc between the points where obstructions necessitate the use of the "step-over".

Plate thicknesses have to be obtained to calculate the internal circumferences.

The heights of courses or tiers are measured internally where possible. If the tank contains liquid then the external heights of courses are taken and due allowance made for horizontal seam overlaps.

Allowance must be made for internal fittings such as coils, supports, etc., known as dead-wood. The dimensions of dead-wood have to be taken and the heights from the datum point to the bottom and top of all dead-wood are recorded so that due allowance can be made at the correct position in the tank table.

Tank bottoms are seldom level and if the capacity of the bottom is required it can best be measured by running in known

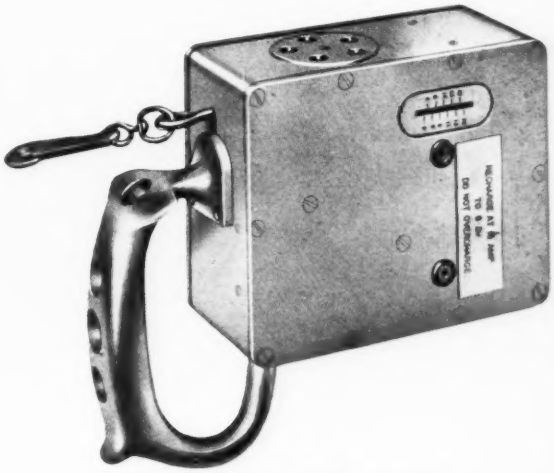

Fig 2. *A Harling-Redwood dynamometer.*

*Paper read to the Institute of Petroleum, London Branch, 19 November, 1953.

†B. and R. Redwood.

quantities of water until the floor is covered up to the predetermined datum line. When no water is available oil may be used but products lighter than gas oil are not recommended because of loss by evaporation, and crude oil should be avoided if possible.

Internal Diameter Method

This method, as the name indicates, involves the measurement of the average diameter of a tank at various heights. As in the case of the strapping method the tank should have been submitted to a water test before calibrating.

In the case of vertical tanks it is normally sufficient to take a

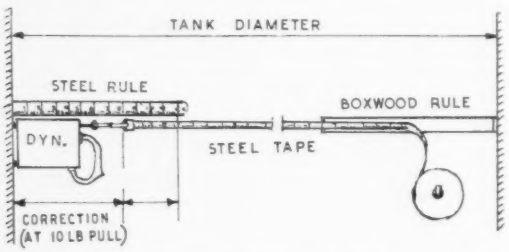

Fig 3. *Method of correcting for length of dynamometer when measuring internal diameters.*

minimum of three diameters on each plate in each course. The measurements of the diameters are shown on the third tier in Fig 1 and are taken near the bottom, middle, and top of each plate from selected positions to points diametrically opposite. The positions at which these diameters are taken are described in the IP *Petroleum Measurement Manual*, pages 13 and 14.

Fig 2 shows a Harling-Redwood Dynamometer of the bell type, with an aluminium body and handle and a steel spring and hook. It consists of a box containing the spring, electric bell, and dry cell batteries so arranged that a pull of 10 lb applied to the hook causes the bell to ring.

A dynamometer, of the bell or buzzer type, is attached to the zero end of the tape. When a tension of 10 lb is reached, *i.e.* the tension at which the tape is standard, the bell rings and a measurement is taken at the other end of the tape. The measurement is taken by placing a boxwood rule end-on to the plate and pulling the tape along the rule until the necessary tension is registered. A firm grip is maintained on the rule and tape to prevent any alteration in their relative positions. The tension is then released and a reading taken at the end of the rule which was against the side of the tank. Each measurement is recorded on the tank side in chalk to indicate the position at which it was taken.

The addition to be made for the length of the dynamometer is accurately recorded before it is put into commission and subsequently checked each time before and after use. Fig 3 shows a steel rule above the dynamometer. The tape is pulled until the bell rings when a reading on the tape is taken at the 12-inch mark on the rule. The difference between the tape reading and 12 inches is the correction to be added.

The sag of the tape should be calculated and allowed for on each average diameter of each course. No allowance for stretch need be made providing each measurement is taken with a pull equivalent to that at which the tape is standard.

Allowances for dead-wood and water calibration of tank bottoms may be carried out as in the strapping method.

Water Calibration Method

The calibration of receptacles by running off or running in measured quantities of water is a lengthy operation. It is normally used only for small receptacles and calls for a great deal of care and patience. However, the water method is sometimes used for calibrating spheroids and this will be referred to later. The calibration of tank bottoms has already been dealt with.

The principle for calibrating small receptacles is to fill the receptacle with water and draw off quantities into standardized measures. The depth of water in the receptacle when full is noted and after each desired quantity has been run off the depth of water remaining is measured and recorded. Temperatures are taken at intervals to ensure that no radical alteration takes place during the calibration.

Floating-Roof Tanks

Fig 4 illustrates diagrammatically the various types of floating roof in use.

The top diagram shows a pontoon-type floating roof which consists of a circular steel deck with a pontoon round the periphery providing the necessary buoyancy. The steel leg supports are equally spaced and can be adjusted to allow the roof to ground in a high or low position. The low position is used when the tank is in operation.

The second diagram shows the double-deck type of roof with two decks one above the other providing a continuous buoyancy space. This is frequently fitted in smaller-diameter tanks.

The next diagram shows the pan-type roof which consists of an inverted conical-shaped deck, the shape being maintained by a number of tiebars and turnbuckles.

The bottom diagram shows the high-deck type of roof where a slightly inverted conical deck is buoyed both at the centre and at the sides by pontoons.

The calibration of the shell of a tank fitted with a floating roof is carried out in a similar manner to that of an ordinary cylindrical fixed-roof tank.

Sufficient dimensions of the floating roof and fittings are taken to enable the makers' weight to be verified.

In cases where the displacement of the roof is required, over the range between the lowest point of the roof to the point of incipient flotation, the roof shape must be determined and measured and its volumetric displacement calculated in increments from the lowest point of the roof to the point where the roof becomes just oil-borne. Alternatively the roof can be calibrated by the water method.

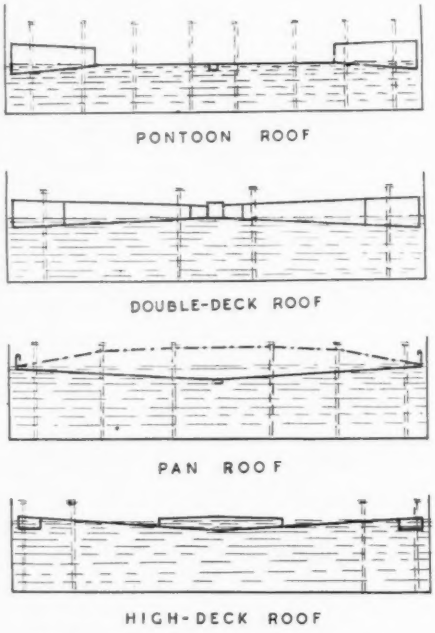

Fig 4. *Different types of floating roof.*

The displacement of the roof for each inch must be regarded as being only approximate because any alteration in floor levels may cause the roof to come to rest on its supports in a different position to that at the time of calibration.

Fig 5 shows the roof supported clear of the liquid, supported with the liquid beginning to rise, and freely floating. When measuring quantities in or out of a floating-roof tank the roof should be freely floating both before and after each operation. The correction for the roof displacement should be used only for stocktaking purposes.

Vertical Cylindrical Tanks with Concave or Convex Bottoms

This type of tank is normally of small diameter and the cylindrical section from the base of the bottom side plates upwards is dealt with as described in the internal measurement method.

The concave space below or the convex space above the cylindrical section can be calibrated either by measurement or water. The measurement method is to be preferred.

A straight-edge is placed in position from the side to the centre of the tank. Measurements are taken from the straight-edge to the curved bottom of the tank at equal distances apart and from the data obtained a curve is plotted from which the necessary calculations are made. The apparatus described in Part II of this paper can be used instead of the straight-edge.

A careful note is made of the position of a point directly under the dip-hole and the calibration table commences from a given increment, say one inch, above this point.

Rectangular Tanks

The dimensions of this type of tank are taken, when possible, internally throughout the height of the tank. A large number of lengths and breadths are necessary as there is a tendency for the sides to bulge or sag at different positions.

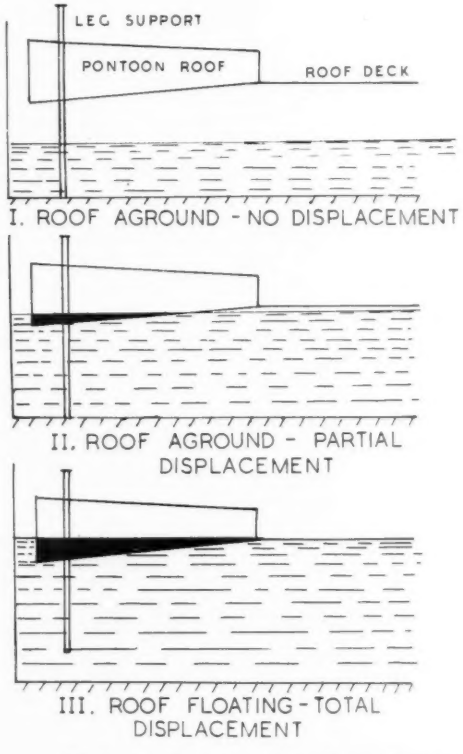
LEG SUPPORT
PONTOON ROOF
ROOF DECK
I. ROOF AGROUND - NO DISPLACEMENT
II. ROOF AGROUND - PARTIAL DISPLACEMENT
III. ROOF FLOATING - TOTAL DISPLACEMENT

Fig 5. Roof positions in floating-roof tanks.

Horizontal Cylindrical Tanks

This type of tank is measured by either the strapping or the internal diameter method. In the strapping method circumferences are measured by three strappings per course in planes at right angles to the longitudinal axis of the tank. Frequent measurements of the length are recorded. In the internal diameter method it is usual to take three sets of four diameters on each course (one vertical, one horizontal, and two diagonal). In addition it is necessary to take frequent measurements of the length.

Where the cylinders have rounded ends they are dealt with in a similar manner to vertical tanks with dished bottoms, a straight-edge being placed at the necessary position to enable measurements to be taken in order that curves can be plotted.

In the case of tanks sloped to either end it is necessary to ascertain the amount of slope and the exact position of the dipping reference point. When the diameter of the tank does not exceed nine feet there is no need to use a dynamometer as for such a short length the correction is negligible. All dead-wood must be carefully measured and each position where it commences and ends carefully noted.

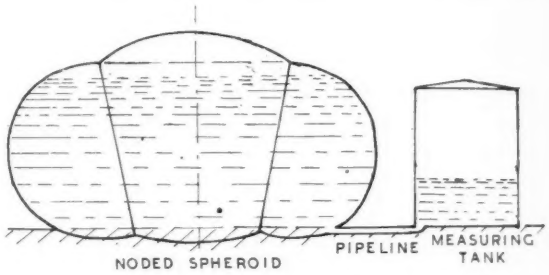

Fig. 6. Water calibration of spheroids.

Spheres

These are spherical vessels used for the storage of volatile liquids and gases under pressure. By virtue of their shaping, calibration by measurement, either by internal or external methods, presents almost insuperable difficulties.

These tanks can, of course, be calibrated by the water method but it is a lengthy operation and may not produce calibration tables of any greater accuracy than those based on theoretical gauging tables because the construction of each sphere conforms closely to the specified dimensions.

Spheroids

These are also pressure containers for the storage of volatile liquids and their purpose is to prevent excessive evaporation losses which may occur when such products are stored in ordinary storage tanks. (See Fig 6.)

As in the case of the sphere the shape of the spheroid renders calibration by measurement a most difficult operation. The best method is water calibration in spite of the fact that it is necessarily a lengthy operation.

First it is necessary to enter the spheroid and adjust the automatic float gauge. The tape measurement indicated on the gauge is compared with the actual distance the float is from the bottom. Any variation can be easily adjusted until the two measurements are identical. The spheroid is then filled with water.

The receiving tank should be as near as possible to the spheroid and fitted with an automatic gauge. This tank should, if possible, be of small dimensions. Sufficient water should be run into the receiving tank to cover the floor and all bottom dead-wood. The pipeline from spheroid to receiving tank must be filled with water.

The transfer of the water is carried out by air pressure in the spheroid and must be carefully maintained at normal working

pressure. A gauge is fitted to the air-line at a position convenient for the operator to observe and adjust the gauge when necessary.

Gauge measurements are then taken by each of the operators on the spheroid and on the receiving tank and recorded. These two operators must be in full view of each other and a prearranged system of manual signalling must be agreed upon.

The spheroid operator indicates by a prearranged signal that the water has begun to flow into the receiving tank and the receiving tank operator, thus warned, closely observes the reaction on the automatic gauge. The second prearranged signal warns the receiving tank operator to stand by and at the third signal he takes a reading simultaneously with a reading taken on the automatic gauge on the spheroid. This third signal is given when one exact inch has gone out of the spheroid. If possible, it is an advantage for the receiving tank operator to have an assistant to tell him exactly when to take his gauge reading and thus obviate the time lag between receiving the signal and reading the gauge.

This operation continues until the receiving tank is full. The last readings on both receptacles are then taken and the receiving tank emptied before commencing successive operations until the spheroid is empty.

The final calibration scales are prepared giving the gallons for each inch of height and cumulative gallons for each inch of height.

Part II—Calibration of Tankers with Description of a Method of Improved Accuracy Developed by the Author

The calibration scales of large ocean-going tankers are almost invariably prepared by the builders. Cross-sections of the ship in the region of the cargo tanks are prepared from measurements taken from the moulding loft or scrieve boards where, for purposes of the construction of the vessel, each frame is drawn to the actual size. From this information the approximate capacity of each tank is calculated and calibration scales prepared.

Dead-wood is not carefully measured and the allowance is only made on a percentage basis according to the size of the ship.

Calibration scales prepared in this manner are not, of course, of the same degree of accuracy as those prepared for shore storage receptacles which are of a more uniform shape. However, ships' calibration scales are extremely useful for the comparison of quantities after loading and before discharging, and thus provide the means of establishing whether any loss has occurred during the voyage.

To an increasing extent small tankers are used for bunkering direct into large vessels and the quantities delivered have to be based and paid for on the bunkering vessel's calibration scales. Builders' charts are, therefore, no longer sufficiently accurate for this purpose.

This is not the only reason why more accurate calibration scales are now in demand. In the case of coasting and bunkering vessels loaded from the new huge refineries and tank farms recently erected in the British Isles, the very large diameter tanks and extremely long pipelines used (12, 16, or 24 inches in diameter) have decreased the accuracy of quantities based on shore figures and in many cases rendered them practically useless. A three-hundred-ton coaster may, for example, be loaded through a pipeline with a capacity of two hundred tons, with no facilities for taking the temperature of the line contents.

The calibration of tankers presents a much more difficult problem than the calibration of shore storage tanks because the latter are much more uniform in shape.

Water calibration of small tankers is not economical because it involves laying up the vessel for a considerable period and is also less accurate than calibration by physical measurement.

Practically no information has been published on the calibration by measurement of small tankers and it is therefore proposed to describe the method in greater detail than in the case of tank

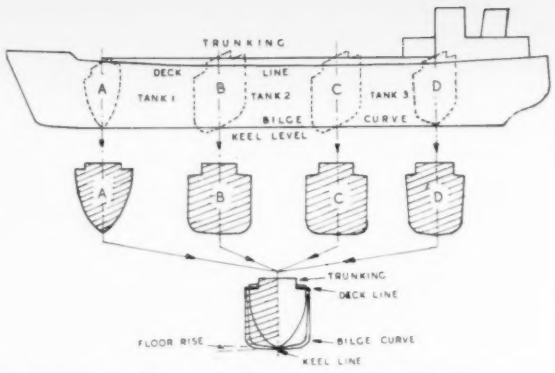

Fig 7. Hull of typical bunkering tanker, with cross-sections.

calibration. Fig 7 shows a diagram of the hull of a typical bunkering tanker with a number of cross-sections illustrated below.

To understand the basic principles of the method it is necessary to describe the general shape and lines of the hull of a tanker, which are as follows:

(1) The keel runs in a straight level line along the bottom of the hull and provides the only level base, from which all measurements are correlated.

(2) The floor or bottom in the midship section is nearly flat with a slight slope rising to join the sides, but the slope increases and becomes very pronounced at bow and stern.

(3) The bilge curve rounds the floor into the sides, is at a minimum in the midship section, and again increases towards bow and stern.

(4) The sides or walls are nearly vertical at the midship section, but slope more acutely towards the keel at bow and stern.

(5) The deck line slopes from forward down to midship and slightly rises again to aft and is not parallel with the keel. In addition the deck slopes from the centre line to port and starboard sides in a parabolic curve.

(6) The expansion space may be continuous in the form of trunking (*i.e.* a rectangular section fitted on to the deck) or may be cylindrical like a steam dome on a locomotive.

(7) The vessel's hull is divided into compartments or tanks by a central longitudinal bulkhead and transverse bulkheads.

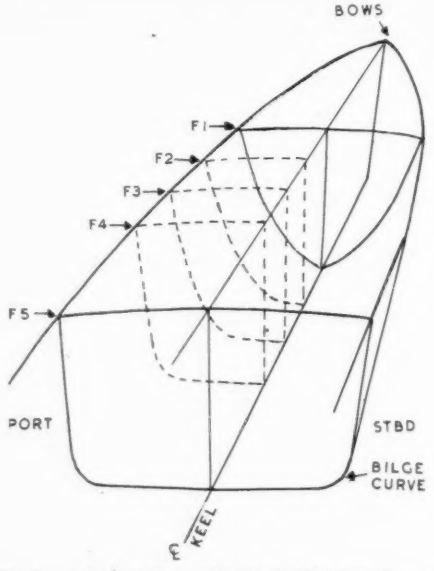

Fig 8. A typical forward tank divided into frames.

The Measurement of Small Tankers

The necessary physical measurements form the basis for the preparation of the calibration scales and therefore it is very important that no omissions occur in this part of the work. It is not possible to lay down any definite set of rules for taking physical measurements, but an attempt will be made to describe generally the principal measurements needed.

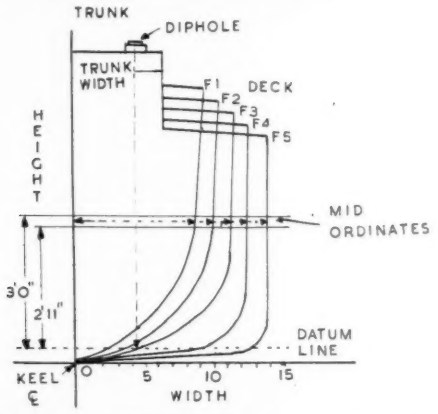

Fig 9. Frame contours plotted for calibration of vessel.

In calibration work it is convenient to refer to a particular cross-section of the hull by a frame number—these may be the original blue-print numbers or a purely arbitrary reference to cross-sections selected by the calibrator. The location number and spacing of frames varies with the extent of the change in shape and curvature of the hull and usually conforms to a certain pattern so that calculations are simplified by applying one of the mathematical rules.

Fig 8 shows a typical forward tank, F1 is the forward transverse bulkhead, F5 the after transverse bulkhead, and F2, F3, and F4 are intermediate frames. In practice, of course, more frames are measured than are shown in this figure.

It will be understood that in a forward tank a rapid change of shape occurs in the frames towards the bow, which makes it necessary to measure them at more frequent intervals. The frames

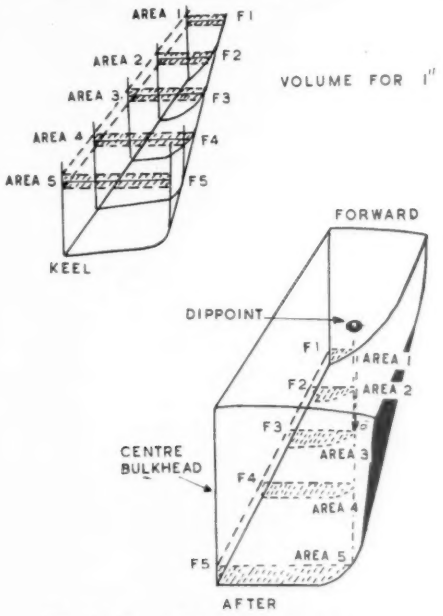

Fig 10. Total floor volume under datum.

are located in their exact position by measuring their relative distance from the forward bulkhead of the tank.

From the field measurements the frame contours are scaled down and plotted on the drawing board (see Fig 9). In practice as many as thirty frames are used in calibrating a vessel of about 400 tons capacity.

The keel forms the zero point at which the intersection of the vertical and horizontal axes coincides with the central longitudinal bulkhead. Thus the curves represent individual cross-sections of the vessel's hull at various points in its length.

The datum point is situated on the floor directly beneath the plug or ullage hole in the dipping hatch and it is important to locate a frame at this position. The areas of the frames below the datum line and the respective lengths separating them are computed according to Simpson's rule or variations thereof to give the volume of liquid contained in the tank when the liquid just reaches the datum on the floor vertically below the ullage or dip hole. (See Fig 10.)

The areas of the frames above the datum line are taken at one-inch increments upwards, and calculated as before to give the volume per inch in height.

It will be appreciated that only very broad outlines of the method can be given owing to the limited space available.

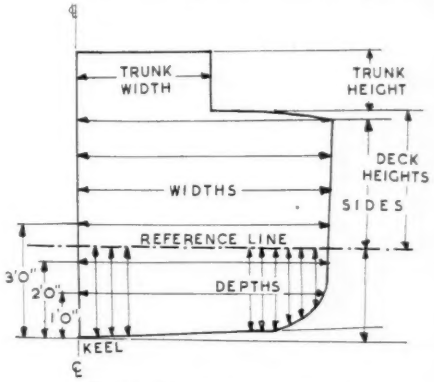

Fig 11. Frame measurements.

Other aspects of the volume calculation, such as that of the roof will, therefore, have to be excluded.

All dead-wood must be carefully measured and allowance made for its displacement at positions where it occurs in relation to the datum point.

Some consideration of the broad outline of the method of taking the physical measurements will be of interest as from these measurements the curves are plotted. (See Fig 11.) The measurements required are as follows:

(1) Horizontal widths are measured at six-inch intervals above the keel at the centre bulkhead.

(2) Depths are taken vertically from the reference line, which is usually a horizontal line about three feet above the keel, to the floor at six-inch intervals from the sides to the centre bulkhead.

(3) The contours of the roof are obtained by taking a series of vertical measurements from a horizontal reference line above the roof at regular intervals.

Measuring Apparatus

Suitable apparatus for taking the field measurements is essential and upon the efficient design of this apparatus the speed of operation and accuracy of measurement depend. (See Fig 12.) The apparatus consists of:

(1) Two magnets, powerful enough to overcome the resistance of scale or rust on the tank sides, and support, under tension, a steel wire marked off in six-inch divisions.

(2) A machine-divided triangular-section bar of light non-ferrous metal, with a level incorporated.

(3) An adjustable telescopic "unipod" leg.

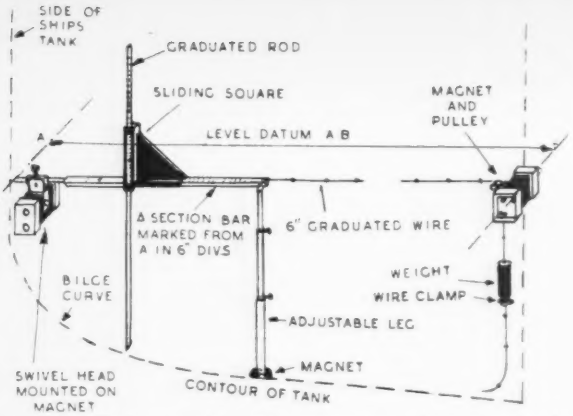

Fig 12. Apparatus used in the measurement of small tanks for calibration. Points A and B are levelled with the liquid inclinometer.

(4) A lead weight which is attached to one end of the steel wire to maintain a steady tension.

(5) Boxwood set-square and triangular-section measuring rod for use where curvature is extensive.

(6) Dynamometer as previously described.

(7) Standard $\frac{3}{8}$-inch steel tape.

It is essential that the vessel must be afloat in calm water. Any list can be rectified by placing weights either on the port or starboard sides of the deck. A highly sensitive inclinometer can be used consisting of two vertical glass tubes, located opposite each other on either side of the trunking or deck, which are joined by a length of thin rubber tubing containing a coloured and non-viscous liquid. When the heights of liquid above the deck are identical the vessel is upright.

The same apparatus is used to establish the horizontal reference lines in the vessel's tanks at each frame location.

Calibration scales are computed on the basis of the vessel being on an even keel but in cases where the dip or ullage holes are not situated in the centre of the tanks, trim correction tables are necessary. However, the vessel is normally on an even keel only when fully loaded and tends to settle by the stern when carrying a part cargo. The slope from forward to aft gives rise to certain inaccuracies such as an increased ullage, volume change owing to alteration in the wetted surface area, and air locks owing to the slope of the tank causing air to be trapped between the rising surface of liquid and the roof or deck.

Instructions for calibration given in this paper are, of course, in general terms only. An operator who carries out this work must possess an extensive knowledge of every detail required for the preparation of tank tables in the office. A great deal of experience is therefore essential and personal initiative may often be required to deal with unusual features.

The total quantity of oil received into and delivered from tanks and tankers over a period of years is very imposing. Consequently a calibrator must appreciate that an inaccuracy, however slight, in the original field measurements will cause errors in quantity which, being cumulative, may in time reach alarming totals.

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U.K. PETROLEUM CONSUMPTION

Figures published by the Petroleum Information Bureau on behalf of the U.K. Petroleum Industry Advisory Committee show that U.K. oil consumption (excluding bunkers) was almost one million tons heavier during the period January to June, 1954 than it was during the same period of 1953.

Sales of premier grade motor spirit to dealers and commercial consumers continued to increase but there was a decline in sales of standard grades.

Detailed figures are as follows:—

U.K. Deliveries into Inland Consumption of Petroleum Products (in tons) January to June

Product	1953	1954
Motor spirit (incl. motor benzole)	2,750,362	2,811,280
Industrial spirits (incl. industrial benzole)	46,305	59,620
White spirit	70,005	73,741
Kerosine:		
Burning oil	300,364	335,504
Vaporizing oil	428,811	379,631
Total kerosine	729,175	715,135
Derv fuel	605,990	671,304
Gas, diesel, and fuel oils:		
Gas–diesel oil	879,539	984,676
Fuel oil	1,920,167	2,228,701
Total gas, diesel, and fuel oils (excl. refinery consumption)	2,799,706	3,213,377
Refinery consumption	701,552	932,019
Total gas, diesel, and fuel oils (incl. refinery consumption)	3,501,258	4,145,396
Lubricating oils and greases	383,801	421,805
Paraffin wax and scale	18,291	22,494
Propane and butane	24,814	27,872
Bitumen	355,883	401,699
Other products	816,513	936,906
Total all products	9,302,397	10,287,252

Note: Deliveries for bunkers for ships engaged in the foreign trade are not included. Figures refer to *inland consumption* only.

U.K. Motor Spirit Deliveries to Dealers and Commercial Consumers (in tons) January to June

Category and Grade	1953	1954
Dealers:		
Premier grades	966,563	1,162,013
Standard grades	817,921	693,866
Total	1,784,484	1,855,879
Commercial consumers:		
Premier grades	111,729	143,857
Standard grades	854,149	811,544
Total	965,878	955,401
Total:		
Premier grades	1,078,292	1,305,870
Standard grades	1,672,070	1,505,410
Total	2,750,362	2,811,280

* * *

IP ECONOMICS AND OPERATIONS GROUP

Members of the IP Economics and Operations Group are invited to attend a meeting to be held at 26 Portland Place, London, W.1. on Thursday, 14 October at 5.30 p.m.

The meeting will take the form of a discussion on "Recent Trends in the Handling of Oil Products in the U.K." which will be opened by S. D. Colwell of Shell-Mex and B.P. Ltd. Mr. Colwell will give a survey of practice and latest developments in storage, issues by road, rail and water, and marketing and distribution in the post-war years.

Attendance at the meeting is limited to Group members, but they may be accompanied by one guest. Light refreshments will be served at 5 p.m.

Around the Branches

FAWLEY, LONDON, NORTHERN, PERSIAN GULF, SCOTTISH, SOUTH EASTERN, SOUTH WALES, STANLOW, TRINIDAD

Persian Gulf Branch—Bahrain Sub-Branch

Over 50 members and guests assembled at Sitra Gate School on 20 April for a meeting at which the founder-chairman, R. Godfrey, handed over his office to L. E. Machin, who had served very actively on the committee for a year. Mr Machin, in an appreciation of Mr Godfrey's services, referred to his initiative in starting the Bahrain Sub-Branch from a handful of members and his constant efforts ever since. He handed over

R. Godfrey, founder-chairman of the Bahrain Sub-Branch, welcoming L. E. Machin (right) as the new chairman of the Branch.

a well-established and active organization. The election of H. G. Spence as secretary was also announced.

A paper by K. S. Lennie on "Some Aspects of Industrial Psychology" was very well presented, and made easy to follow by the speaker's use of a large number of wall chart summaries and diagrams.

Great interest was reflected in the discussion to which nearly half the audience contributed. The panel of Dr W. J. Moody, O.B.E., B. W. Teague, and J. Jefferson with the author, handled questions with aplomb, all showing respect for the many and diverse opinions which are held on this subject.

The meeting closed at 11.0 p.m. with votes of thanks to the author and panel, proposed by W. H. Cotter, and to the management of Bapco for facilities provided, proposed by the chairman.

Paper on Refinery Operations

The 23rd ordinary meeting of the Bahrain Sub-Branch was held at the Bapco preparatory school, Sitra Gate, on 10 May.

L. E. Machin was in the chair and K. Wilson presented a paper on the "Activity Analysis of Petroleum Refinery Operations".

The paper covered the presentation and solution of a problem concerning the operation of a hypothetical refinery in such a way as to realize the maximum profit. The paper illustrated the way to attack the problem using methods based on the modern linear algebraic and matrix theory.

The author made use of a series of wall charts to demonstrate these methods without, however, attempting to justify the mathematics. An interesting discussion followed, the main theme of which was concerned with the practical limitations and scope of statistical methods as related to machines currently available.

H. J. McKim proposed a vote of thanks to the author which was carried with acclaim.

Bahrain

The 24th ordinary meeting of the Bahrain Sub-Branch was held at the Bapco preparatory school on 5 June, when the founder-chairman, R. Godfrey, gave a talk on Bahrain, which covered some aspects of Bapco operations with which he had been concerned during his long career with the Company. He described some of the earlier drilling operations and showed one of his own films covering the rigging-up at one of the wells.

He continued by outlining seismographic methods as applied to off-shore operations and illustrated them with another of his films, which was remarkable for the colour and beauty of the sea scenes.

After a number of questions had been answered by the speaker, the recent Bapco film "Bahrain" was shown.

W. H. Cotter proposed a vote of thanks to Mr Godfrey for his talk and for his work and enthusiasm in starting the Bahrain activities of the Institute. H. G. Spence seconded and expressed the meeting's good wishes for Mr Godfrey's happiness and success in his future work.

Communications in Industry

The 25th ordinary meeting of the Bahrain Sub-Branch was held in the Bapco preparatory school on Monday, 5 July. L. E. Machin was in the chair.

F. W. Higgins gave a talk entitled "Communications in Industry". He began with an historical review of the transmission of messages, ranging from the courier systems of the Mogul and Persian Emperors, through the early nineteenth century "penny post", to present-day airmail, and from drums and smoke signals, via the telephone, to automatic morse senders and teleprinters. Descriptions of the working of automatic telephones followed, with demonstrations of pieces of equipment. The relative merits of different systems and their application in industry were then dealt with.

The discussion was mostly on the latter part of the talk and many interesting aspects were raised.

R. Craig proposed a vote of thanks to the speaker for his talk. The attendance was regrettably small, but those present had a very good evening, finishing in the Awali telephone exchange at 11 p.m.

Well-logging

The 26th ordinary meeting of the Bahrain Sub-Branch was held on Saturday, 7 August, in Sitra Gate School, when Alan Rushton, an engineer of Schlumberger Overseas, was the guest speaker at a well-attended meeting. L. E. Machin was in the chair.

In the opening stages of his talk, Mr Rushton traced the history of well-logging from its earliest days to the running of the first successful electric oil-well log, which was obtained for the Shell Company in their La Rosa, Cabimas Field (Venezuela) in the year 1928.

The next phase of the paper dealt with the development of electric logging from the days of the manually-operated single curve to the present-day multiple curves from mechanically controlled equipment. The introduction of each development was explained both from the theoretical and practical standpoints by the speaker. In addition, key sections of the equipment, both old and new, were on view at the meeting.

In concluding, the speaker ventured a look into the future of well-logging and the ambitious plans his Company had for future research. Then followed an interesting discussion indicating that the paper had been well received. The meeting concluded with a vote of thanks to the speaker proposed by R. K. Smith.

Anglo-Iranian's Aden Refinery

The coming "on-stream" of the new 5,000,000-tons-a-year refinery at Aden is an important landmark in the Anglo-Iranian Oil Company's programme of refining expansion. Now, the oil bunkering port of Aden, important port-of-call for vessels en route from Europe to the East, will be able to supply oil direct from Kuwait after refining six miles away across the bay at Little Aden; thus eliminating the wasteful transhipment of crude oil from the Gulf to the United Kingdom for refining and back again to Aden.

More than 4500 ships call at Aden each year, making Aden one

The No. 1 crude distillation unit and flare stack.

of the biggest suppliers of ships' bunkers in the Eastern Hemisphere. Other principal markets to be served by the Aden refinery are the Red Sea and Indian Ocean areas.

Work began on the new refinery in November 1952 and it has been brought into commission after only 21 months and four months ahead of schedule. This is a feat of concentrated effort on a project with an estimated total cost of £45 million. British, American, and European technicians totalling 2500 have been employed on the task, together with 10,000 Arabs and Indians.

Working Conditions

When work first began, the liner *Dorsetshire* was anchored at Aden and used as a floating home for four and a half months while the first contingent of 150 men erected prefabricated barrack buildings at Little Aden.

By the beginning of 1954 this number had increased to 14,000. Several permanent water wells were drilled in the desert to meet the fresh-water requirements and two main construction camps were built. One—air-conditioned—housed British, American, and European workers, and the other was sub-divided for Arab, Somali, Levantine, and Indian workers. A prefabricated 200-bed hospital was erected and comprehensive facilities were provided in both camps, including churches, messes, shops, open-air cinemas, and provision for sports and recreation.

Full co-operation in these matters was maintained between the Anglo-Iranian Oil Company and the Aden Government authorities responsible for the municipal facilities at Little Aden.

Permanent Living Conditions

The Aden Municipality is also assisting in the provision of amenities for the permanent operating staff of 250 Britons and 11,500 Arabs and Indians which will work at Little Aden. Housing estates have been provided with roads, drainage, water, and electricity, and the Municipality is encouraging the development of private enterprise business and shopping facilities.

On these estates house building is proceeding in two stages. First of all, 75 prefabricated houses, each air-conditioned, are being erected for British staff families and 100 houses for labour families. The second stage of development includes the construction of 150 houses for Arab and Indian married foremen and clerks, 200 houses for married labour, and 60 houses for bachelor labour.

Production

Aden refinery will have a capacity of 5,000,000 tons of crude oil per year and its yearly production will include 3,000,000 tons of marine bunker oils; 300,000 tons of gas oil; 400,000 tons of aviation turbine fuels and burning kerosine; 100,000 tons of power kerosine, and 900,000 tons of motor gasoline.

Of the bunker oils for ships, over 2,000,000 tons a year will be pumped 19 miles through two specially-laid pipelines from the refinery to the Aden BP bunkering installations. The petrol, kerosine, and diesel oil will supply the markets of the Red Sea and Indian Ocean area.

Refinery Plant and Processes

The refinery plant includes two distillation units, each with a throughput of 60,000 barrels per day, which are the first to be electronically controlled. Raw kerosine from these units can be treated in the SO_2 plant at the rate of 8000 barrels per day, and power kerosine can be desulphurized in the autofiner at the rate of 3000 barrels per day. The Aden platformer is a 12,000-barrels-per-day unit.

Products requiring further refining treatment pass through the caustic washery, solutizer, and copper chloride plants.

A view from the South-East showing the two crude distillation units and the power house.

The permanent power station with three 7500 kW turbo-alternators, together with a power station built for the construction phase, serves the refinery and Little Aden area. The installed capacity of the battery providing steam for the power station and refinery totals 600,000 lb per hour.

There are over 100 tanks in the tank farms, the largest storing crude oil in quantities of 6,500,000 gallons.

Pipelines

Of the two 19-mile pipelines joining the refinery to the bunkering installations at Aden, one is 16 inches and the other 6 inches in diameter. "Go-devils" will prevent contamination in the pipelines when grades are changed. They are made of steel and rubber and make an effective partition between different oil products. The "go-devils" are fitted with radio-active capsules which give automatic warning at the Aden installation before arrival. The installation operator then knows when to open and close the valves so that the pipelines discharge into the correct tanks.

Submarine pipelines connect the Aden tanks with eight off-shore loading points and several barges are also available to supplement the service. A new "dumb" barge, *BP Aden*, was recently towed from the U.K. to Aden by ocean-going tug. With a capacity of 500 tons, this is now the biggest bunkering barge at the port.

The Oil Port

Accommodation for four 32,000-ton tankers is available at the port adjacent to the refinery. There is one finger jetty, berthing two tankers, and two T-head jetties. The approach channel and turning circle have been dredged and the sand used to reclaim an area of 200 acres on which tanks and port offices have been erected.

Municipal Works

A high-level bridge, some 800 feet long, has been built over the Khor Bir Ahmed, on the route between the refinery site and Aden, and an arterial road has been constructed between Little Aden and Aden. The distance between these two points has been reduced to 19 miles by the building of a causeway across the Aden inner harbour.

The Contractors

Contractors for the refinery were a consortium of the Middle East Bechtel Corporation, an American company, and George Wimpey and Company Ltd., of Great Britain. George Wimpey and Company also built the oil port, dredging being carried out by a British-Dutch combine. Rendel, Palmer, and Tritton of London were the consulting engineers for the port construction and dredging.

The opening of the valve on the crude oil supply line to the No. 1 crude distillation unit.

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Trade Literature, etc.

Fire Cements

A leaflet giving particulars of fire cements and a hot patching cement manufactured by J. H. Sankey & Son Ltd. is available from the firm's Refractories Division, Ilford, Essex.

Welding Stainless Steel

"Some Notes on the Welding of Stainless Steel" is the title of a technical booklet issued by Rockweld Ltd. of Commerce Way, Croydon, Surrey, manufacturers of electrodes and welding equipment. The aim of this publication is to bridge the gap between the theory and practice of welding by a series of brief notes on various aspects of the subject.

Coryton Refinery

"Lummus Ltd. at Coryton" is the title of an illustrated booklet published by The Lummus Company Ltd., the firm of construction engineers which built the Vacuum Oil Company's new refinery at Coryton. The entire construction programme is described in the booklet, including the effects of the flood period of 1953.

U.K. Marketing of PRC Aircraft Sealants

British Paints Ltd. have recently become the licensed representatives in the U.K. and all sterling countries for aircraft sealants produced by the Products Research Company of Los Angeles, California. Limited quantities of these sealants are now available in the U.K. for those engaged on work of national importance. Enquiries for advice and information should be addressed to British Paints Ltd., Crewe House, Curzon Street, London, W.1.

"Unistrut" Catalogue

"Unistrut" metal framing constructed by the Unistrut Division of Sankey-Sheldon Ltd., 46 Cannon St., London, E.C.4, is described in an illustrated catalogue recently published.

"Porvic"

A new filtering medium, "Porvic", has been developed by British Filters Ltd. of Maidenhead in association with the Pritchett and Gold and E.P.S. Company Ltd. "Porvic" is unplasticized polyvinyl-chloride, made porous by a special process. This new filter is said to combine uniform particle retention with a fast rate of flow. It is also resistant to chemical attack and cannot contaminate the filtrate.

Electronic Process Control

Two illustrated leaflets dealing with electronic process control have recently been published by Evershed and Vignoles Ltd. Publication 272 gives a pictorial survey of various types of panels and control desks which have recently been supplied by that firm, including the control desks supplied for the crude distillation units of the new Aden refinery. Publication 295 contains a detailed description of the Evershed Process Controller Mark 3 for controlling flow, temperature, pressure, etc.

Both leaflets can be obtained free of charge from the firm's Publicity Department, Acton Lane Works, Chiswick, London, W.4.

Personal Notes

R. Godfrey, founder-chairman of the Bahrain Sub-Branch of the Institute and formerly manager of producing and development for the Bahrain Petroleum Company Ltd., left Bahrain in June this year. After a vacation in the United Kingdom he will take up an appointment in the New York office of the California Texas Oil Company.

J. W. Campbell, chief accountant and assistant secretary of Stewarts and Lloyds Ltd. has been released by Stewarts and Lloyds so that he may continue as Financial Adviser to the Iron and Steel Agency. Mr Campbell was originally seconded to the Iron and Steel Corporation in 1951 and became Financial Adviser to the Iron and Steel Agency on its formation.

W. L. Jollie is to replace Mr Campbell as chief accountant of Stewarts and Lloyds Ltd. and all U.K. subsidiaries. Mr Jollie was previously chief accountant and assistant secretary of the Stanton Ironworks Company Ltd.

A. C. Vivian, B.Sc., F.Inst.Pet., who was project manager for the Anglo-Iranian Company's post-war expansion at Llandarcy, has retired after thirty years service with the Company.

Mr Vivian spent most of his career in the London office of the Company where he was manager of the Civil and General Branch of the Engineering Division from 1935 until 1947, with a break during the war years. In 1947 Mr Vivian became projects manager for the expansion of the Llandarcy refinery—a scheme which resulted in the raising of Llandarcy's annual capacity from 360,000 to 4,000,000 tons.

He has recently been appointed managing director of Metal and Pipeline Endurance Ltd., a subsidiary of William Press and Sons Ltd.

Dr R. K. Stratford, F.Inst.Pet., of Imperial Oil Ltd., Sarnia, Ontario, was presented with the Medal of the Chemical Institute of Canada at its recent annual convention. In February last he was also the recipient of the Medal of the Society of Chemical Industry (Canada). He is the first person to receive both awards in the same year.

Dr W. B. Peutherer, F.Inst.Pet., general manager of Grangemouth refinery, has been elected President of the Grangemouth and District Chamber of Commerce.

A. J. Littlewood, A.F.Inst.Pet., has recently taken up a new appointment with Foster Wheeler Ltd. as co-ordination engineer for the Fawley refinery project.

W. H. Simmons, B.Sc., F.R.I.C., M.Inst.Pet., analytical and consulting chemist, has taken into partnership **R. Stern,** B.Sc., A.R.I.C., and the practice at The Laboratory, 24 Grosvenor Gardens, London, S.W.1 will in future be carried on under the name of Simmons and Stern.

Regent Oil Co. Appointments

Regent Oil Company Ltd. recently announced the following new staff appointments:

F. E. W. Laurie has retired from his position as Regent's Western Branch manager, and is to take up duties in the General Sales Division at the Company's Head Office. Mr Laurie joined the sales organization of Trinidad Leaseholds Ltd. in 1933 and has spent most of his business career in the West Country, becoming divisional superintendent, Avonmouth, in 1934 and assistant to the Branch manager, Western Counties, in 1938. In 1939 he joined the Petroleum Board as assistant manager, S.W. Regional Office, and transferred to the Regent Oil Company Ltd. as Western Branch manager on its formation in 1948.

He is succeeded as Western Branch manager by **H. J. Tanner,** former North Western Branch manager of the Regent Oil Company Ltd. Mr Tanner is an original member of the Texas Company. He came to the Regent Oil Company on its formation in 1948 as assistant to the London Branch manager. After becoming divisional manager, Nottingham, in 1949 he was appointed North Western Branch manager in 1951.

A. B. Mumford takes up the appointment of manager, North Western Branch, Regent Oil Company, in succession to Mr Tanner. Mr Mumford entered the oil industry in 1938 as a member of the Texas Oil Company. After serving in the army he returned to the Texas Oil Company, joining Regent on its formation in 1948. Mr Mumford has also had experience in Jamaica while assigned to work for Trinidad Leaseholds Ltd., a parent of the Regent Oil Company. Until recently Mr Mumford was divisional manager, Avonmouth.

W. H. Goodhind has left the Regent Oil Company to become manager of the Supply and Distribution Department of the Caltex Trading and Transport Company Ltd., where he will be responsible for all problems dealing with supply, distribution, and lube oil marketing in the sterling area—outside the United Kingdom. Mr Goodhind first joined the Texas Company in 1934, transferring to Regent Oil Company in 1948 as wholesale manager and later becoming lube oil manager. He also became a director of Bulk Lubricants Ltd.

K. Potter succeeds Mr Goodhind as manager of the Industrial and Automotive Lubricants Department. He joined the Texas Oil Company in 1946 and transferred to Regent in 1948 as industrial engineer, Technical Division. In 1951 he was appointed assistant to Mr Goodhind. Mr Potter is a chartered mechanical engineer.

R. D. Cranfield, formerly Regent Oil Company's divisional manager, South Wales, succeeds Mr Mumford as divisional manager, Avonmouth. Mr Cranfield joined Regent in 1948 after spending two years with the North Western Branch sales force.

Two other staff changes which have taken place in the Regent Oil Company recently are the new appointments of **S. H. Trott** and **J. Forshaw.** Mr Trott, who was formerly divisional manager, Exeter, has now moved to the North Western Branch and become divisional manager, Liverpool. He was originally on the staff of Trinidad Leaseholds Ltd., which he joined in 1936, coming to Regent on its formation in 1948.

Mr Forshaw joined the Regent Oil Company in 1948 and has been on the Company's North Western Branch sales force as sales superintendent, Leeds Division. He has now transferred to Western Branch and holds the position of divisional manager, Exeter.

J. H. Williams, for many years on the sales staff of the Midland Branch of the Regent Oil Company Ltd., has now become divisional manager, South Wales Division. Mr Williams joined the Texas Oil Company in 1933.

New Esso Appointments

Consequent upon changes in organization, Esso Development Co. Ltd. has abolished the post of Manager of Research Department, held by **Dr T. K. Hanson,** F.Inst.Pet. Two new posts have been created and Dr Hanson has been appointed Research Manager, while **K. C. Hunt,** F.Inst.Pet., has been given the position of Laboratories Manager. Mr Hunt was formerly manager of Technical Sales Department of Esso Petroleum Co. Ltd., a position which is now filled by **Dr W. E. J. Broom,** F.Inst.Pet. The new manager of the Industrial Sales Department replacing Dr Broom is **H. L. Bugbee,** A.M.Inst.Pet., formerly sales manager of Esso's London Division.

Laying the Pipelines between Kwinana and Fremantle

Distribution Facilities at Australia's New Refinery

By the end of this year the 3,000,000 tons a year capacity refinery being built at Kwinana, Western Australia, by Australasian Petroleum Refinery Limited, Anglo-Iranian Oil Company's Australian associate, will be connected with the nearby port of Fremantle by two high-pressure products pipelines. Work on the trenching and laying of the lines began early this year. Products from the refinery should be flowing through the pipelines early in 1955.

One pipeline, of 12-inch diameter and 15 miles long, will carry fuel oil to ships' bunkering installations on Fremantle harbour, the busiest oil bunkering port in Australia. The other, a 6-inch-diameter line 17 miles long, will cross the Swan River and terminate at a distribution depot. Through this line will be pumped white oils for distribution throughout Western Australia.

The 12-inch line with its two duplex double-acting ram pumps, steam driven, has been designed to transfer approximately 400,000 tons a year of black oils. Heat lost to the ground from the lighter black products, which are to be pumped hot, will be used to reduce the heat loss of the heavier oils to follow. The white oil line, to which motor-driven centrifugal pumps will be connected, is designed to transfer about 550,000 tons of products a year.

The two lines are being laid side by side and will lie buried beneath from four to 12 feet of earth and rock. Their route generally follows that of a proposed trunk highway on which construction will start next year.

Local contractors were given the job of digging the 4 feet 6 inch-wide trench to take the pipelines and their work has been completed. Where space is limited both lines are being laid in a common trench, but where the right-of-way and the subsoil permit excavation by a mechanical ditcher the pipes are being laid in individual trenches. Some of the trenching has proved difficult, one section three-quarters of a mile long having to be cut 12 feet deep through solid limestone.

Not far behind the trench-diggers have come the pipelayers and welders, who are naturally taking great care to prevent any weaknesses developing in the future because of the high pressure nature of the lines when in commission.

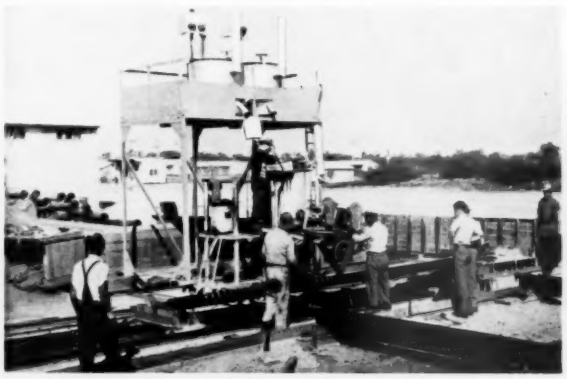
Several of these men have had pipe-laying experience in other parts of the world but their ingenuity has been tested at times at Kwinana. One of the first problems was the need to construct a special machine to bend the piping to the curves along the route. No machine was available but one was designed and built with a rugged frame of large diameter piping, and a cargo winch fitted with pipe grips to pull the pipe to the desired angle without distortion.

The pipelines are tested at every stage of construction. Their 40-feet lengths are seamless, solid-drawn pipes specially made for the job, the 6-inch ones having been fabricated in Australia and the 12-inch in the United Kingdom. To defeat rust the pipes receive a coating of bitumen enamel, and a wrapping of fibreglass is bound into this while hot to insulate against galvanic action. This process is taken further by giving the pipes a second, tougher wrapping of asbestos and glass fibre impregnated with asphaltic pitch. Provision is being made to provide future cathodic protection for the pipelines if this is found necessary.

Along the pipeline itself a mobile X-ray unit is working at full pressure to check each welded joint in the line. Examination of the X-ray plates enables the smallest weaknesses to be detected.

Built at Kwinana, the unit uses up to 120,000 volts in its oil-cooled X-ray tube and takes three photographs of each welded joint. Faulty welding is cut out with a blow-torch, the pipe edges are rebevelled, and a new full-circle weld is made. Thousands of X-rays will be taken before the job is finished.

After being welded together into lengthy sections the lines are handled into their trench by powerful side-boom tractors. Before the pipes are laid, however, testing is carried out. First a "pig", consisting of a series of rubber disks and wire brushes, is passed through the sections. In this way internal rust and stones, and even snakes and animals which may have crawled into the piping despite covering of the open ends, are cleaned out. Next the sections are sealed at either end and subjected to air and water pressure tests. After these tests have been successfully completed another "pig" removes any traces of water, clears the line of air, and makes it ready to receive the first flow of refinery products.



Pipelaying at Kwinana: (left) *the pipe-wrapping machine in operation;* (right) *welded sections of the pipelines ready to be laid in the trench.*

Books

Thirty-one Years of LPG Sales

Details of liquefied petroleum gas sales in the United States during the period 1922 to 1952 are available in a recent publication.* This shows that total sales of all gases steadily rose from 223,000 U.S. gallons in 1922 to 4,477,379,000 in 1952. The report gives considerable details of quantities used for various purposes and of sales in various areas. Data for 1952 extracted from the report show quantities sold for various purposes:

	Butane	*Propane*	*Butane-propane mixtures*	*Total*
	Thousand U.S. gal			
Domestic and commercial	107,858	1,509,534	648,786	2,266,178
Gas manufacture	26,400	206,573	26,724	259,697
Industrial	53,333	215,471	56,163	324,967
Synthetic rubber	343,691	246	27,060	370,997
Chemical plants	81,367	422,130	367,493	870,990
Internal combustion	25,965	149,845	194,748	370,558
All other uses	668	9,796	3,528	13,992
TOTAL	639,282	2,513,595	1,324,502	4,477,379

Aircraft Fuelling

A colourful handbook published recently by Shell sets out all the essential information required by aircraft fuelling crews to ensure that no danger can arise either from the products supplied or from the process of fuelling. Safeguards must be taken against contamination of products by water or dirt and these are described together with routine tests of purity.

Fire precautions are described in detail and rules are also given for efficient maintenance and operation of fuelling equipment.

British Standards Yearbook

British Standards Yearbook, 1954 edition, contains a brief description of the subject matter of each of the 2500 British Standards current at 31 March 1954. Information is also given on the membership of the Institution's councils and committees and on the work in hand of all the Industry Standards Committees.

British Standards under which the Institution's certification trade marks are used are listed separately and there is a comprehensive index.

Copies of the *Yearbook* can be obtained from the Institution, British Standards House, 2 Park Street, London, W.1. Price 12*s* 6*d*.

First Fawley Foundation Lecture

"Science and Industry—the Pattern of the Future?" was the title of the first Fawley lecture delivered by Sir Harold Hartley, K.C.V.O., M.C., F.R.S., on 20 May this year.

The Fawley Foundation, established in the University of Southampton by the Esso Petroleum Company Ltd. in 1953, provides for the delivery of a series of annual public lectures under the general title of "Science and Industry".

Sir Harold opened his inaugural lecture by reviewing the way in which science and industry had combined to meet the world's needs during the past fifty years. He then looked forward to the year 2000 and tried to assess what needs would have to be met at that date.

In making this assessment Sir Harold considered whether certain agents—water, energy, metal, and minerals—were likely to limit development. Sir Harold concluded that limitations in our resources would present serious problems during the next half century but said that he did not believe the problems would prove insoluble if they were faced in time. With our greater knowledge and swift communications it would be easier, Sir Harold said, to see the world's problems as a whole and the inescapable community of interest among nations that they involve. One thing was certain, Sir Harold concluded, the material future would depend on the ever closer working of science and industry, and on the closer partnership of man with nature.

Sir Harold's lecture has now been published in booklet form and can be obtained from the University of Southampton, price 2*s* 6*d*.

Hydrocarbons in Italy

With Rome as the venue in 1955 of the Fourth World Petroleum Congress, the subject of hydrocarbons in Italy is topical and it is of interest to note that the January 1954 issue of the Banco di Roma's "Review of Economic Conditions in Italy" features this subject. Following a short article by Ing. E. Mattei, Chairman of Ente Nazionale Idrocarburi, on "Natural gas and natural steam in the Italian economy", there are four special articles, as follows:

"Italian mining legislation", by Prof S. Ilardi (*University of Rome*);

"Oil and methane in Italy", by Dr Ing. A. Giarratana;

"Delivery and utilization of methane in Italy", by Dr Ing. A. Giarratana;

"The Italian refinery industry", by G. Spantigati.

Kent Oil Refinery

Two illustrated booklets, one for the lay reader and one for the more technically-minded, have been produced by the Anglo-Iranian Oil Company Ltd. to tell the story of the Kent oil refinery on the Isle of Grain. The general booklet is entitled "The Kent Oil Refinery: the Construction Story" and the more specialized approach is given in "A Technical Description of the Kent Oil Refinery".

Both booklets contain a number of photographs and charts, and the more technical of the two gives many details of the various units and processes.

Copies are obtainable from the General Department, Anglo-Iranian Oil Company Ltd., Finsbury Circus, London, E.C.2.

Bristol Engines

"Bristol Engines Around the World" is the title of a copiously-illustrated brochure published by the Bristol Aeroplane Company Ltd. The Company's factory at Filton, near Bristol, is divided broadly into two main groups, the Aircraft Division and the Engine Division, and it is the development and present-day activities of the latter division which are described in this book.

The brochure deals first of all with some of the Company's early aero-engines and then turns to its present-day production of piston, propeller turbine, and jet engines.

An outline is also given of the Bristol Service Organization and of the Company's engine overhaul bases throughout the world.

**A Third of a Century of LP Gas sales*, 1922-52. A. T. Coumbe and I. F. Avery. U.S. Bur. Min. Inf. Circ. 7684, May 1954.

How Big is a Ship?

A series of articles on volumetric and avoirdupois tonnages of ships

By J. ANTHONY HIND*, A.M.I.N.A.

PART I—THE HISTORY OF CAPACITY MEASUREMENTS AND AN EXPLANATION OF WEIGHT TERMS

Introduction

Whereas naval architects, shipowners, shipbuilders, shipbrokers, and marine insurance men know exactly, by a kind of mental yardstick, the size and to some extent the commercial ability of a ship by the mere mention of a tonnage, there may well be others less intimately connected with the sea to whom the various tonnages have little meaning. Indeed, even those who have spent all their lives with ships sometimes wonder at the complicated and rather artificial way in which they are measured.

The reasons for measuring ships are fairly obvious to all, but the ways in which this is done are far from being obvious to the uninitiated, especially when the word "ton" has often nothing to do with weight at all! The answer is to be found in the archives and traditions of merchant shipping.

Measurement of Capacity—Historical

It is sometimes suggested that the word "ton" owes its adoption to the Continental wine trade of the 13th Century, when the wine came in casks called "tuns" which were nearly all the same size. Vessels employed in the trade were of different sizes and a handy way of understanding the various sizes of vessel was to say they could carry so many tuns of wine. This method became universal and even if a vessel was not engaged in the wine trade, shippers, knowing the size of a wine tun, also had a knowledge of the capacity of her cargo hold. "Tunnage" has now been corrupted to "tonnage" when capacity is inferred. In the particular cases of gross tonnage or net tonnage (which will be fully described in Part II of this series) it must be remembered that they are measures of capacity not of weight.

The first important system of tonnage measurement was initiated in 1773 and became known as the Builders' Old Measurement (B.O.M.). This was, however, not a satisfactory system as it had a bad influence on British ship design, a fact appreciated by contributors to the early *Transactions of the Institution of Naval Architects*. Finally, after numerous efforts to have the rule changed a Royal Commission was appointed in 1833, but without satisfactory results and a new Royal Commission sat in 1849. George Moorsom was its secretary and this "Moorsom System", as it has been known ever since, was embodied in the Merchant Shipping Act of 1854 on which all the tonnage laws and regulations of the important maritime nations are still based to the present day.

Briefly, the idea of this Act was to measure the total capacity of the ship in cubic feet and divide it by an easy divisor. The figure 100 was selected. Tonnage, therefore, is the result of the division and the unit of 100 cubic feet is known as the register ton, since the assessment is required to be registered. Various deductions are allowed from this tonnage figure so that every vessel has two tonnages which have become known as gross and net. It is confusing to use the term register tonnage as this can refer quite properly to either.

The basis for assessment of dues for services rendered to a vessel has been the subject of great controversy from time immemorial and it is likely to continue as long as there are ships to sail the seas. It is argued that net tonnage is a measurement of a ship's earning capacity where similar tonnages are being considered, but indebtedness and ability to pay do not always go hand in hand. However, the "pros and cons" of this everlasting question are much beyond the scope of this article and the reader is referred to the wealth of interesting reading which can be found elsewhere.

Measurement of Weight

Let us leave for a short while the measurement of a ship's capacity, which is embodied in the tonnage laws and regulations, and consider the actual measurements used to describe weight in ships as expressed in tons of 2240 lb.

One often hears of a ship being described as a so many thousand-tons-deadweight cargo carrier or oil tanker and this is a very common description in the case of a ship specially designed to carry cargoes in bulk. It is, of course, a measure of the actual weight that the ship has been designed to carry, the unit of measurement being a ton of 2240 lb. The figure which is quoted as deadweight includes not only the cargo, which should be specifically referred to as cargo deadweight, but also all consumables on board, such as stores, provisions, bunkers, feed and fresh water, and crew and their effects. Thus:

Cargo deadweight or "pay" load + consumables
= (total) deadweight.

The actual weight of a ship and all that it contains is equal to the weight of the water that could be put into the cavity that the ship leaves in the water, if the reader can imagine the ship being lifted bodily and the water remaining as if it were a solid mass. In other words, the ship displaces from the space it occupies a weight of fluid equal to its own weight—the well-known Principle of Archimedes. This weight is known as the ship's displacement. When the ship has no cargo or consumables aboard, the light displacement or lightship is referred to and the load displacement is that at which the vessel attains her maximum draught, which in the case of a merchant ship is fixed by law. Thus:

Light displacement (ship empty) + deadweight
= load displacement.

One rarely sees the displacement of a merchant ship quoted, even in the technical Press, as it is not of very much interest outside designing circles. What is of interest is the carrying and therefore the earning ability of the ship. In the case of a warship, capacity tonnages in terms of gross and net are never quoted (it may not generally be known that they do have them). Their quoted tonnage is nearly always some loaded displacement, which may not be a "fighting ship" displacement, and one is required to take it on faith. This is the Standard Displacement under the Washington Treaty and does not include fuel or reserve feed water. It is often referred to as the "legend", and can be found in the Navy List.

*Naval Architect, Hardy, Tobin and Co. Ltd.

Notes of the Month

World's Heaviest Process Vessel

Two halves of the bottom head for the heaviest process vessel ever designed left the workshops of The M.W. Kellogg Company recently. The halves are to be joined at the site to form the bottom of the reactor vessel for a 30,000-b.d. fluid hydroforming plant under construction by Kellogg.

The reactor vessel will be approximately 135 feet high with an internal diameter of 23½ feet. On top of this will stand a smaller vessel in which catalyst for the reforming process is regenerated. When complete, the unit will rise more than 200 feet above its supporting pedestal.

A vertical strut pipe being fitted into one half of the head to prevent distortion during transit to the site.

Multi-tier Control Gear

Over fifty multi-tier cubicle switchboards have been supplied by The General Electric Co. Ltd. for installation at the new Amlwch and Ellesmere Port works of the Associated Ethyl Co. Ltd. The General Electric Company was given the contract for the whole of the 415 V motor control gear to be installed.

The cubicles are of pressed steel construction, requiring no supporting framework, and consist either of single panels the full height of the board or of smaller panels mounted in tiers. The cubicles are stove-enamelled and each one is divided vertically into front and rear compartments; the front containing contactors, relays, fuses, and other components which may require attention, and the rear housing the busbars, cables, current and voltage transformers, etc.

New Shell-Mex and B.P. House

The North-Eastern Division of Shell-Mex and B.P. Ltd. is to have its headquarters in a new building at Leeds. Teleprinters, pneumatic message tubes, and a mechanized accounting system are among the facilities to be installed in the three floors of Shell offices.

Standard-Vacuum Tanker Launched from British Yard

The importance of the event to the British economy as well as to the Standard-Vacuum Transportation Company was strongly emphasized when a 26,500-dwt supertanker, *Stanvac India*, was launched recently near Liverpool.

Four years ago the British Government and the Standard-Vacuum Oil Company concluded an agreement whereby a new company—Standard-Vacuum Transportation Company—should be incorporated under British law. The agreement also provided for two supertankers to be built for this Company in U.K. shipyards to sail under the British flag. As a result of this agreement the Company is able to carry oil cargoes to sterling areas for sterling payment instead of payment in dollars.

Speaking of the advantages of this arrangement, H. W. McCobb, vice-president and director of the Standard-Vacuum Oil Company, said that the agreement meant a saving of dollars for sterling areas and to his Company it meant much greater flexibility in the conduct of its business. He welcomed the Britain-Stanvac agreement as a fine example of a free nation and a free enterprise corporation reaching an intelligent arrangement which crumbled a corner of the currency exchange barrier.

Representatives of the British and Indian Governments and of the international petroleum and transportation industries were present at the launching ceremony which was performed by Mrs H. W. McCobb at the yard of Cammell Laird and Company Ltd. near Liverpool.

The *Stanvac India* will carry crude oil from the producing areas of the Eastern hemisphere to Standard-Vacuum refineries in India, South Africa, Australia, and Japan. She is capable of carrying nearly eight million Imperial gallons at a speed of 17 knots.

A sister ship is nearing completion at the yards of John Brown and Company (Clydebank) Ltd., near Glasgow.

Oil Search in Nigeria

A show of oil has been encountered in a well at Ituk Mbang in the Calabar Province of the Eastern Region of Nigeria. This is the second show to be encountered in this area and the Shell D'Arcy Petroleum Development Company of Nigeria Ltd. which is prospecting in this area, is making further tests to discover whether or not oil is present in commercial quantities.

Scottish Industries Exhibition

Held in the Kelvin Hall, Glasgow, 2-18 September 1954, and promoted by the Scottish Council, the Scottish Industries Exhibition was in effect a Trade Fair of Scottish manufactures. With over 200 exhibitors, a wide range of materials and machinery was on show from abrasives to woollen goods, aircraft structures

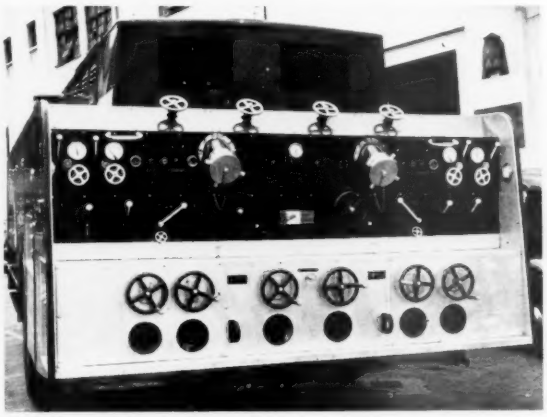
The stand of Scottish Oils Ltd., exhibitors at the Scottish Industries Exhibition.

to wash basins, petroleum to soft drinks. The principal petroleum exhibit was that of Scottish Oils Ltd., their stand being devoted to the shale oil industry and its products and depicting recent additions to the Grangemouth refinery. There was also much to interest the petroleum industry in the form of machinery and equipment on the various stands.

New Fire-fighting Tender

A recent demonstration of fire-fighting appliances developed by The Pyrene Company for oil refineries and storage tank farms included a new fire-fighting tender with an output of 10,000 gallons of foam per minute.

The tender has been specially designed for an overseas refinery. It is built on a Leyland "Hippo" chassis and carries a bulk supply of 650 gallons of foam-making compound. From this a total of 180,000 gallons of foam can be supplied without replenishment



The control panel of the Pyrene foam fire-fighting tender for oil refineries and storage tank farms.

of stocks. Water at 100 p.s.i. can also be supplied at a rate of 1960 gallons per minute.

Another recent "Pyrene" development is a crash tender equipped with new foam-making appliances and a number of these tenders are to be supplied to the R.A.F. for airfield use. Foam will be supplied from the tenders in powerful, far-reaching jets at a high rate of discharge; it will be possible for 6000 gallons of foam to be produced within 1½ minutes.

Engineering Training at Nottingham University

Departments of chemical and production engineering may be developed at the University of Nottingham in the near future. The Dean of the Faculty of Applied Science at the University, Professor J. A. Pope, D.Sc., Ph.D., Wh.Sch., M.I.Mech.E., Professor of Engineering at Nottingham, recently visited the Cardon refinery and the oilfields and installations of Cia Shell de Venezuela in South America at the invitation of the Shell Petroleum Company Ltd.

The object of Professor Pope's visit was to obtain first-hand information on conditions in the oilfields and refineries and to examine the type of training required by engineering graduates entering the industry. Professor Pope later went to visit universities in the U.S.A. to study methods of training chemical and production engineers.

The Shell Petroleum Company Ltd. and the "Shell" Refining and Marketing Company Ltd. are co-operating with the Engineering Department of Nottingham University in a new scheme for training engineers. Under this scheme, potential graduates spend one year in industry after school, followed by three years at the University and a final year in industry to complete their practical training.

AIOC Part in Australian Oil Search

Anglo-Iranian has increased its interest in the oil search in Australia by participating, through its prospecting subsidiary, D'Arcy Exploration Co., in a new company, Frome Lakes Pty Ltd., which intends to embark without delay on a vigorous exploration programme, including drilling, in south-east Victoria.

Frome Lakes Pty Ltd., has been formed by Frome-Broken Hill Pty Ltd. (in which the D'Arcy Company and subsidiaries of the Consolidated Zinc Corporation and Standard Vacuum Oil Company are shareholders), Lakes Oil Ltd., and the Austral Oil Drilling Syndicate.

Anglo-Iranian has been concerned since 1946, through the D'Arcy Company, in Frome-Broken Hill's extensive exploration for oil and gas in wide areas of Australia.

AOC Scholarships for Indian Students

Seven Indian students have been awarded scholarships for advanced scientific and technical training abroad under the AOC scholarship scheme administered by the Council of Scientific and Industrial Research.

The scholars sailed to the U.K. early in September to take up the scholarships which are normally tenable for two years.

The Assam Oil Company introduced this scholarship scheme in 1952 to help to fit young Indians for specialist posts in research institutions, Government-sponsored public utility concerns, etc., and industry. The Company spends 1,00,000 rupees on the scheme each year.

AIOC Tanker Launchings

British Sovereign, the fifth 32,000-dwt tanker to join Anglo-Iranian's British Tanker Company fleet, was launched from the Barrow yards of Vickers-Armstrong on 31 August. The launching ceremony was performed by Lady Munro, wife of Sir Gordon Munro who recently joined the Board of AIOC.

The *British Sovereign* will carry an oil cargo of approximately 30,000 tons at a loaded service speed of 15 knots. Her overall length is about 665 feet, her breadth is 85 feet 6 inches, and her loaded summer draught will be 35 feet.

A sixth 32,000-dwt tanker, *British Victory*, is scheduled for launching from the same yards in November this year.

There were two other AIOC launchings during August. At Newcastle-on-Tyne the 16,000-dwt vessel *British Patrol* was launched from the yard of Swan, Hunter, and Wigham Richardson by Mrs Southwell, wife of C. A. P. Southwell, managing director of the Kuwait Oil Company. At Clydeside the *Border Minstrel*, also a 16,000-dwt vessel, was launched by Lady Bruce, wife of the Rt. Hon. Viscount Bruce of Melbourne. The *Border Minstrel* was built by Blythswood Ltd. for the Lowland Tanker Company in which Anglo-Iranian, Common Bros., and Matheson and Company are partners.

New Insecticidal Lacquer

A new chemical product—a lacquer containing two powerful insecticides—has recently been devised and used to protect the troopship *Dunera* which sailed for the Far East in August.

The two insecticides are aldrin and dieldrin, developed recently by Shell, and these are expelled from the lacquer as small invisible crystals. The action is quickened by the friction of insects crawling on the lacquer. Washing and scrubbing do not impair the toxic strength of the lacquer which will last for at least two years after each application.

These insecticidal lacquers have been patented and can only be manufactured under licence from the National Research Development Corporation. The formulation of the lacquer is as follows:

Urea resin (Type B.C. 555)	50 parts by weight
Alkyd resin (Type B.C. 666)	50 ,, ,, ,,
Butanol	27.5 ,, ,, ,,
Xylol	22.5 ,, ,, ,,
Dieldrin	12 ,, ,, ,,
Aldrin	12 ,, ,, ,,

The accelerator (sulphuric acid 10 per cent vol) is finally added to the above in the proportion of 1 : 20.

ABCM Chemical Works Safety Conference

This year's Chemical Works Safety Conference is to be held at Harrogate from 5 to 7 November. The main feature of the

Conference will be visits to the I.C.I. factories at Billingham and Wilton to study safety devices and practices in operation.

At Wilton delegates will visit the olefin plant, the ethylene oxide plant, the glycol plant, the hydrogen compression plant, the formaldehyde plant, and the workshops and power station.

At Billingham delegates will tour the boiler and power plant, the ammonia and ammonia oxidation plants, the hydrogenation (petrol) plant, the ammonium phosphate plant, and the "Nitro-Chalk" plant.

A limited number of applications to attend the conference can still be accepted. Forms can be obtained from the Conference Secretary, Association of British Chemical Manufacturers, Cecil Chambers, 86 Strand, London, W.C.2.

Shell Fleet Expansion

Shell-Mex and B.P. Ltd. are to increase their fleet of estuarial and river craft to a total of 47. Ten new vessels have been or will be ordered from British shipyards for completion in 1955-6 and these will be employed in distributing petroleum products from Shell and Anglo-Iranian refineries in the U.K.

The ships will be diesel-engined and in some cases will be fitted with radar equipment. Nine of them will have Voith Schneider propellers and will therefore have considerable manoeuvrability.

One of the new vessels, a 530-ton coaster now being built at Wallsend-on-Tyne, will soon be ready for launching.

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CRUDE OIL PRODUCTIONS

	1954 *July* *Tons*	*Jan. to July* *Tons*
Basrah Petroleum Co. Ltd.—Zubair	417,322	2,461,860
Iraq Petroleum Co. Ltd.—Kirkuk	2,043,401	13,587,934
Mosul Petroleum Co. Ltd.—Ain Zalah and Butmah	111,678	756,573
Kuwait Oil Co. Ltd.	4,089,294	26,043,445
Qatar Petroleum Co. Ltd.	403,584	2,668,814
	Brl	
Kern Oil Co. Ltd.:		
California	105,600	
Trinidad	81,956	

★ ★ ★

This 4000-gallon semi-trailer tank truck, built by Scammell Lorries Ltd., is one of a number now being put into service by the Esso Petroleum Company Ltd. It is the first vehicle of this type to be supplied to a British oil company.

Skilful design has been necessary to build a truck capable of carrying 4000 gallons of petroleum spirit and yet conforming to the maximum gross weight of 22 tons permitted by the Petroleum Conveyance Regulations. The tank is of the stepped frameless type with five 800-gallon compartments.

HD OILS

The following additional oils have been approved by the Director of Chemical Inspection, Ministry of Supply, as complying with the requirements of Defence Specification DEF 2101.

Supplier and Supplier's Nomenclature	OMD Grade of Oil
British Solvent Oils Ltd.:	
Bri-sol OMD 60	60
Bri-sol OMD 110	110
Bri-sol OMD 330	330
H. C. Sleigh Ltd.:	
Golden Fleece MIL DEF-30	110
B.P. Benzin und Petroleum:	
B.P. Energol HD	110
Dalton & Co. Ltd.:	
Silkolene Nectar 30	110
Joseph Batson & Co. Ltd.:	
Tiptone HD 30 MIL	110
Solvolene Lubricants Ltd.:	
Racine HD 20	60
Racine HD 30	110
Solvol HD 30	110
Racine HD 50	330
National Benzole Co. Ltd.:	
NBC MIL HD 20/20W (202)	60
NBC MIL HD 30 (302)	110
NBC MIL HD 30 (301)	110
NBC MIL HD 50 (501)	330
Gulf Oil (Great Britain) Ltd.:	
Brit. Gulf MNHD 30	110
Brit. Gulf 30 HD	110
Brit. Gulf 20/20 WHD	60
Liberty Oils Ltd.:	
Omegal DM 20	60
Snowdon, Sons & Co. Ltd.:	
Snowdrift MIL 50	330
C. C. Wakefield & Co. Ltd.:	
(Formula No. LH40/54)	110
(Formula No. LH57/54)	110
Deutsche Vacuum Oel A.G.:	
Servac 550	330
The Shell Petroleum Co. Ltd.:	
Shell Oil S 4223	110
Shell Oil S 4270	40
Fletcher Miller Ltd.:	
Hiduta DF 20	60
Hiduta DF 30	110
Hiduta DF 50	330
Alfred Hopps, Sons & Co. Ltd.:	
Byvol GL/HD 20	60
Byvol GL/HD 30	110
Byvol GL/HD 50	330
Power Petroleum Co. Ltd.:	
Power Diesel Oil SAE 20W	60
Power Diesel Oil SAE 30	110
Power Diesel Oil SAE 50	330
W. Blackwell Oil Co. Ltd.:	
Celeritas Vic-30	110
Deutsche Gasolin A.G.:	
Motanol Record	60
Anglo-Iranian Oil Co. Ltd.:	
B.P. Energol Diesel-D	40
Purfina S.A.:	
Motortonic 30 P	110
Gewerkschaft Neue:	
Nerag Motor Oil 500 HD SAE 20/20W	60

Conference on Molecular Spectroscopy

A Conference on Molecular Spectroscopy, organized by the Spectroscopic Panel of the IP Hydrocarbon Research Group, is being held at the Institution of Electrical Engineers (Savoy Place, London, W.C.2) on 28-29 October 1954. From the following list of papers so far arranged it is obvious that the major branches of the subject will be dealt with and the discussions which will ensue are likely to be of considerable value.

The Conference Fee is £2 2*s*., including one set of preprints. A Conference Dinner is also being held at the Waldorf Hotel on 28 October, the cost of tickets, exclusive of wines, being £1 5*s*. Application forms for membership are obtainable from G. N. Ross, Anglo-Iranian Oil Co. Ltd., Chertsey Road, Sunbury-on-Thames, and early registration is desirable.

TENTATIVE PROGRAMME

First Session—9.30-12.30, 28 October

Opening Address. Dr J. W. Barrett, Chairman, Hydrocarbon Research Group.

1. Remarks on the Use of Fluorescence for Industrial Analysis and Examination. E. J. Bowen (Physical Chemical Laboratory, Oxford University).
2. Spectroscopic Studies of the Phosphorescent States of Aromatic Hydrocarbons. G. Porter (Dept. of Physical Chemistry, Cambridge).
3. Raman Spectroscopy. Dr B. F. Dudenbostel (Standard Oil Development Co.).
4. Determination of Aromatic Hydrocarbons in Lubricating Oil Fractions by Far Ultra-Violet Absorption Spectroscopy. R. A. Burdett, L. W. Taylor, and L. C. Jones, Jr. (Shell Oil Company).
5. Punched Cards and the Presentation of Spectral Data. H. W. Thompson, F.R.S. (St John's College, Oxford).

Second Session—2.00-5.00, 28 October

6. Infra-Red Instrumentation—Present and Future. Van Zandt Williams (The Perkin-Elmer Corpn.).
7. Diffraction Gratings and their Use in Infra-Red Spectroscopy. L. A. Sayce and A. Jackson (National Physical Laboratory).
8. The Preparation and Use of Additively-Coloured Alkali Halide Crystals as Infra-Red Transmission Filters. J. Gaunt and W. G. Burns (AERE, Harwell).
9. Measurement with a Caesium Iodide Prism. E. K. Plyler (U.S. National Bureau of Standards).
10. The Pressed Disk Technique in Spectroscopy. M. A. Ford, G. R. Wilkinson, and W. C. Price (King's College, London).

Third Session—9.30-12.30, 29 October

11. The Intensities of Vibrational Absorption Bands. H. W. Thompson, F.R.S. (St John's College, Oxford).
12. The Characteristic Vibration Frequencies of Substituted Benzenes. R. R. Randle and D. H. Whiffen (Birmingham University).
13. The Infra-Red Spectra of some Mono-Deutero-Aromatics and their Analytical Application. E. D. Kunst (Koninklijke/Shell-Laboratorium, Amsterdam).
14. Low-Temperature Infra-Red Spectroscopy. N. Sheppard (Dept. of Colloid Science, Cambridge).

Further Consideration of Punched Cards and the Presentation of Technical Data.

Fourth Session—2.00-5.00, 29 October

15. Chemical Applications of Nuclear Resonance Spectroscopy. R. E. Richards (Lincoln College, Oxford).
16. Spectroscopic Studies on Reactions at High Temperatures. Prof D. F. Hornig (Brown University, Providence, Rhode Island).
17. The Emission Spectra of Molecules and Radicals in the Infra-Red. G. R. Wilkinson, M. A. Ford, and W. C. Price (King's College, London).
18. Infra-Red Absorption Bands of Hydrocarbons Under High Resolving Power. H. W. Thompson, F.R.S. (St John's College, Oxford).
19. The Interpretation and Use of Infra-Red Reflection Spectra. T. S. Robinson and W. C. Price (King's College, London).

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FOURTH WORLD PETROLEUM CONGRESS

Exhibition of Petroleum Equipment

For the first time in the history of the World Petroleum Congress an exhibition of equipment used in the petroleum industry is being arranged in connexion with the Fourth Congress in 1955.

This International Exhibition of Petroleum Industry Equipment is being held during the period 29 May to 30 June. The venue of the exhibition will be the Mostra d'Oltremare (Overseas Fair).

Naples is within easy access from Rome, the seat of the Fourth World Congress, and for the benefit of delegates special transport facilities will be available between the Congress and the Exhibition. The exhibition organizers will also maintain an office in the Congress building.

Equipment used in all branches of the industry will be included in the exhibition and a special feature will be made of plant for the production and handling of natural gas and of liquid petroleum gases.

Full details regarding the Exhibition are obtainable from the Organizzazione Esposizione del Petrolio, 20 Via Tavere, Rome, Italy. (Telegraphic address: Congrespetrol, Rome).

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JOURNALS WANTED

Two members of the Institute are in need respectively of Journal No. 1 (June 1914) and Journal No. 19 (April 1919). Anyone who has either of these for disposal is requested to inform the Editor.

THE VOICE OF THE PAST

A Very Clouded Crystal Ball

The only motive power suitable for military purposes is steam, oil motors being too complicated, while, in addition, the supply of petroleum could not be reckoned on in war time. Report in the *Petroleum Review*, 1900 (now the *Petroleum Times*).

What! No Geophysicists?

The locations have been made on Petroleum Hill and Petroleum Flat, where there have already been a few holes sunk about thirty feet, from which comes an unmistakable odour of petroleum. Both localities are traversed by crevices peculiar to this part of Arizona, and these also emit the odour of oil. Men are running all over the country with crowbars and iron pipes, driving holes and smelling of them for all the world like a lot of dogs looking for rabbits. Report on Arizona, 1900 (*Petroleum Review*).

Management 1900

He also dwelt very strenuously on the question of management. Naturally it must spell either success or failure of the enterprise, yet many of the oil companies started appear to be used by ignorant directors for experimental purposes, that will help them, if they are fortunate enough to learn their lessons quickly and fortune favours them, to blunder on to success. It is a regretful memory that in the Canada Petroleum Company sufficient time was not granted the Directors to blunder on to light and prosperity. Dr Boverton Redwood, 1900 (*Petroleum Review*).

Forthcoming Meetings

THE INSTITUTE

Platforming. G. Egloff, M.A., D.Sc., Ph.D., (Universal Oil Products Company). At the Chemical Society, Burlington House, Piccadilly, London, W.1. **20 October**

Conference on Molecular Spectroscopy. Organized by the Spectroscopic Panel of the Hydrocarbon Research Group. At the Institution of Electrical Engineers, Savoy Place, London, W.C.2. **28-9 October**

The Chromatographic Analysis of Hydrocarbon Mixtures. B. W. Bradford, B.Sc., Ph.D., A.R.C.S., D.I.C., F.R.I.C., F.Inst.Pet., D. Harvey, A.R.I.C., and D. E. Chalkley, B.A., B.Sc. At 26 Portland Place, London, W.1, 5.30 p.m. (tea, 5 p.m.). **10 November**

The Cadman Lecture. Winning Petroleum — A Story of British-American Co-operation. C. A. P. Southwell, C.B.E., M.C., B.Sc. (Kuwait Oil Co. Ltd.). At the Royal Institution, Albemarle Street, London, W.1. **17 November**

IP FAWLEY BRANCH

(*At Esso* (*Fawley*) *Recreation Club, Holbury*, 7.30 *p.m.*)

Chemical Aspects of the Atomic Energy Industry. Dr C. B. Amphlett. **22 October**

The Design and Manufacture of Welded Pressure Vessels. T. B. Webb, B.Sc., M.I.Mech.E., M.A.S.M.E. **19 November**

IP LONDON BRANCH

(*At* 26 *Portland Place, London, W.*1, 6 *p.m.—tea* 5.30 *p.m.*)

Synthetic Rubber in the Commonwealth. J. Walker. **19 October**

Agricultural Pesticides. J. L. Hunt, Dip.Hort. (Wye). **18 November**

IP NORTHERN BRANCH

(*At Engineers' Club, Albert Square, Manchester* 2, 6.30 *p.m.*)

Testing Lubricants for the Prevention or Promotion of Wear. T. B. Lane, M.Sc. Joint meeting with the Manchester Association of Engineers. At 6.45 p.m. **29 October**

Wax—The Most Versatile Product of the Oil Industry. C. F. McCue, B.Sc., and S. Curds. **16 November**

IP SOUTH-EASTERN BRANCH

(*At King's Head Hotel, Rochester*, 7.45 *p.m.*)

Non-destructive Testing and its Uses in Petroleum Industry. Dr F. H. Gotfeld. **2 November**

IP SOUTH WALES BRANCH

(*At the Training Centre, National Oil Refineries Ltd., Llandarcy*, 5.30 *p.m.—tea* 5.0 *p.m.*)

Fire-fighting Techniques in the Petroleum Industry. D. W. Thomas, B.E.M. **7 October**

Ocean-going Tanker Practice. Captain R. A. Page. **4 November**

IP STANLOW BRANCH

(*At the Grosvenor Hotel, Chester*, 7.30 *p.m.*)

Presidential Lecture. International Co-operation in Petroleum. Lt.-Col. S. J. M. Auld, O.B.E., M.C., D.Sc. **18 October**

The Modern Oil Industry. G. Egloff, M.A., D.Sc., Ph.D. **25 October**

Safety Symposium. The Training and Duties of Fire Auxiliaries: T. K. Urmston, Grad. I.F.E. **Safety Permits:** E. R. Harding, I.I.S.O. **Protective Clothing:** H. S. Moore. **17 November**

Film Show. At the Tatler Theatre, Chester. 2.30 p.m. **28 November**

OTHER SOCIETIES

The Place of the Gas Turbine cum Two-stroke Engine–Gas Generator Unit in the Future Pattern of the Oil Engine Industry. The Institution of Mechanical Engineers, Internal Combustion Engine Group. 6.45 p.m. **2 November**

Measurement of Flow. The Institution of Mechanical Engineers, Hydraulics Group. 6.45 p.m. **16 November**

The Utilization of Residual Fuel Oils. C. A. Roast. The Institute of Fuel, East Midland Section, Gas Showrooms, Nottingham. 6.15 p.m. **13 October**

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Five lectures on "Aspects of Friction and Lubrication" will be given on Thursdays at 7.0 p.m. commencing 18 November 1954. Fee for the course £1. Further details and form of application may be obtained from the Head of the Department of Chemistry and Biology.

J. C. JONES
Director of Education

SITUATIONS VACANT

Applications are invited by the Vacuum Oil Company Limited, for the position of **Assistant Chief Chemist** in their Laboratory at Coryton Refinery, Essex. Applicants should have B.Sc., A.R.I.C., or equivalent qualifications and experience in a petroleum laboratory, preferably in a refinery. The work entails the supervision of an analytical testing section, control of refinery processes involved in the production of petroleum products, and all the ancillary problems arising therefrom. The successful applicant will be eligible for consideration in obtaining the tenancy of certain houses available to the Company. Conditions of employment include a Pension and Life Assurance Scheme, generous sickness plan, social club, and other benefits. Applications giving full details of qualifications and experience and quoting reference "A.C." should be addressed to the Industrial Relations Superintendent, Vacuum Oil Company Limited, Coryton Refinery, Coryton, Essex.

Applications are invited by the Vacuum Oil Company Limited, for the following positions at its new refinery at Coryton, Essex: **Assistant Engineers**—Applicants must have a Mechanical Engineering degree and experience preferably in either the petroleum or chemical process industry. However, applications from graduates who have recently left university will be considered. (Ref: A.E.). **Piping Draughtsmen**—Applicants for this position must have piping layout experience in petroleum or chemical process plants. (Ref: D.M.P.) **General Draughtsman**—Wide engineering experience particularly with reference to civil engineering is required for this position. (Ref: D.M.G.) All Draughtsmen applicants must have an O.N.C. and preference will be given to those who are studying for or have obtained a H.N.C. Salaries are progressive and opportunities for promotion excellent. The successful applicants will be eligible for consideration in obtaining the tenancies of certain houses available to the Company. Conditions of employment include a Pension and Life Assurance Scheme, Sickness Benefit Plan, and Sports and Social Club. Applications giving full details of qualifications and experience and quoting the appropriate reference should be addressed to the Industrial Relations Superintendent, Vacuum Oil Company Limited, Coryton Refinery, Coryton, Essex.

UNIVERSITY OF BIRMINGHAM

Department of Chemical Engineering

Applications are invited for the following appointments:—

(*a*) Lecturer in Chemical Engineering. Applicants should have either an Honours Degree in Chemical Engineering or equivalent, with post-graduate or industrial experience in chemical engineering.

(*b*) Lecturer in Petroleum Production Engineering. Applicants should have either an Honours Degree in Petroleum, Chemical or Mechanical Engineering, or Geology, with post-graduate or industrial experience. Preference will be given to candidates with experience in petroleum production engineering.

The appointments will be Grade II (£550×£50—£1,100), the starting salary depending on qualifications and experience. Opportunity will be given for research.

Applications with names of three referees should reach the Registrar, The University, Edgbaston, Birmingham 15, by 1 November 1954.

Further particulars may be obtained from the undersigned.

C. G. BURTON,
Secretary.

The University,
Birmingham, 15.

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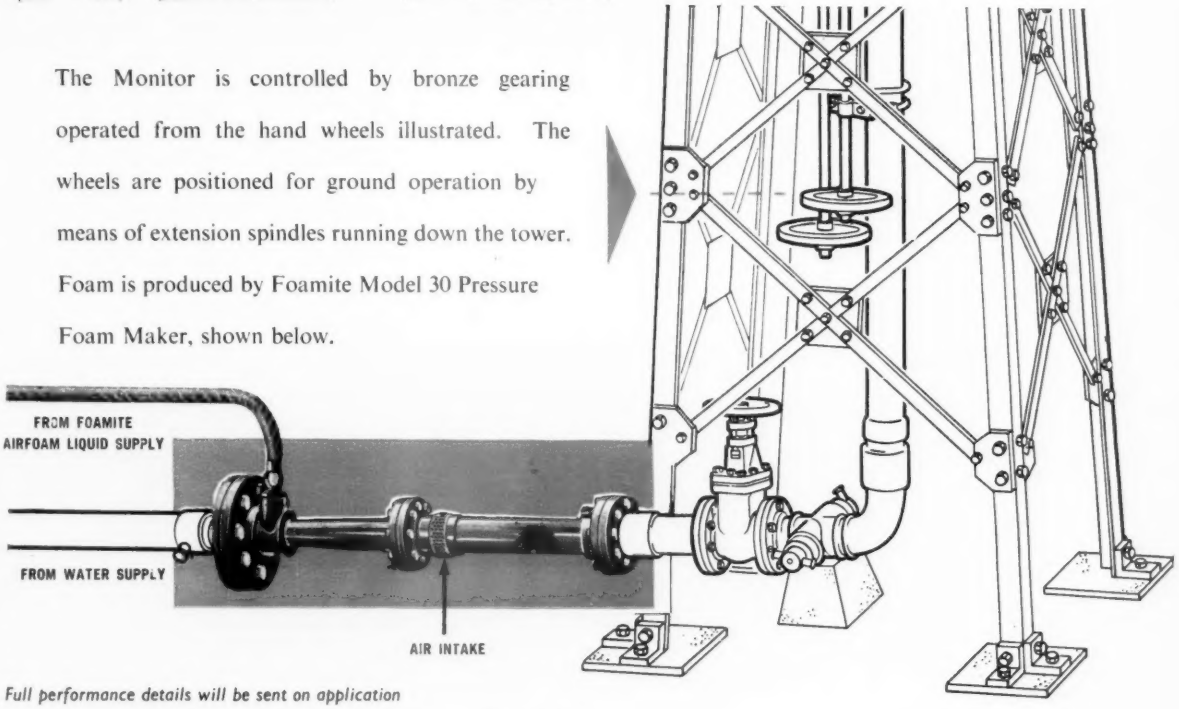

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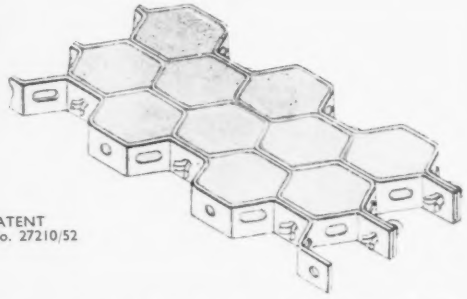

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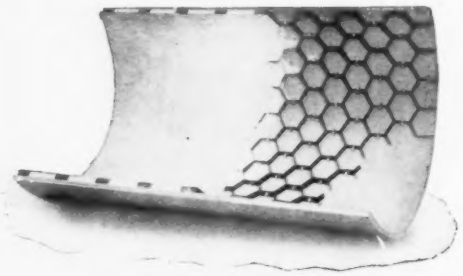

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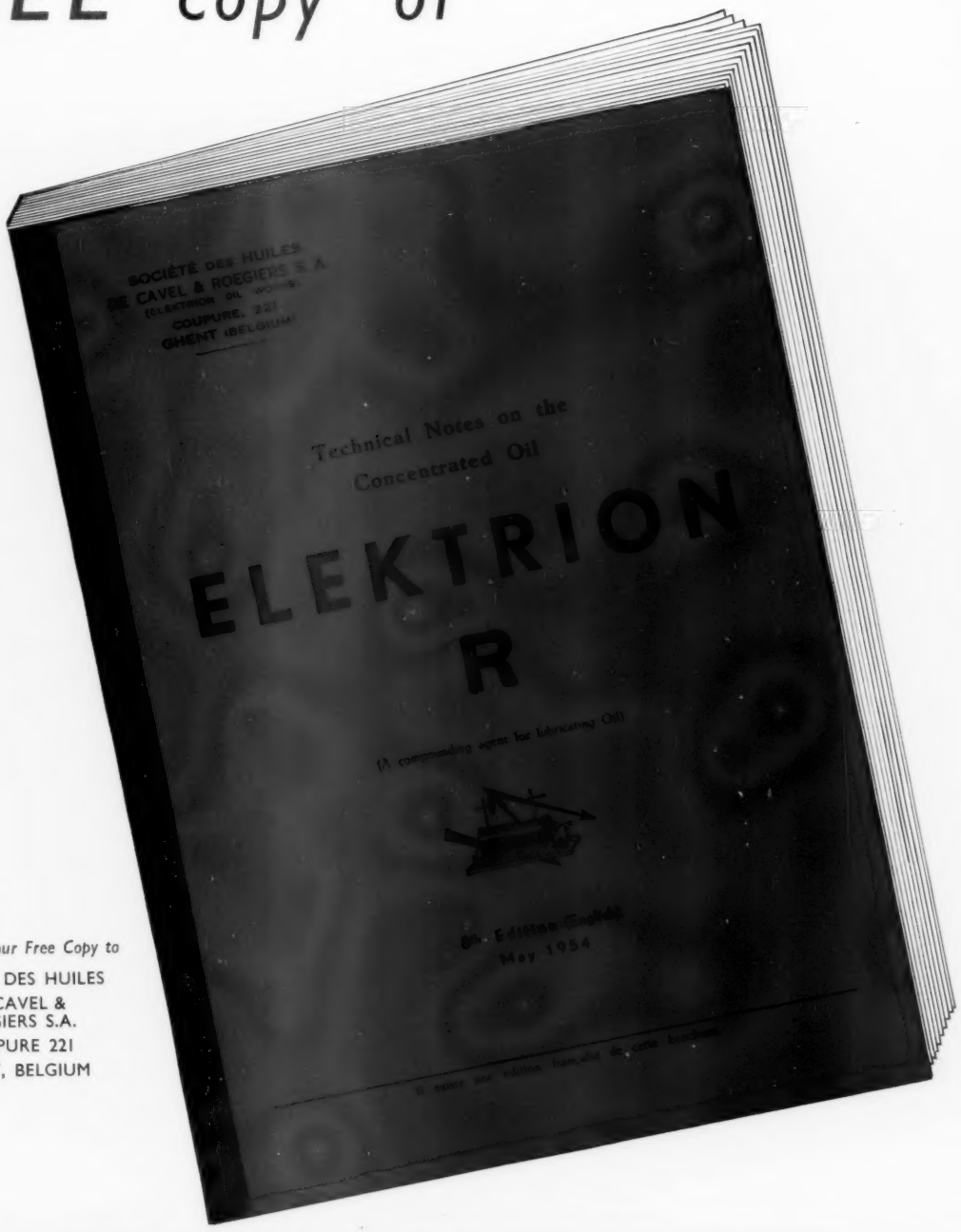

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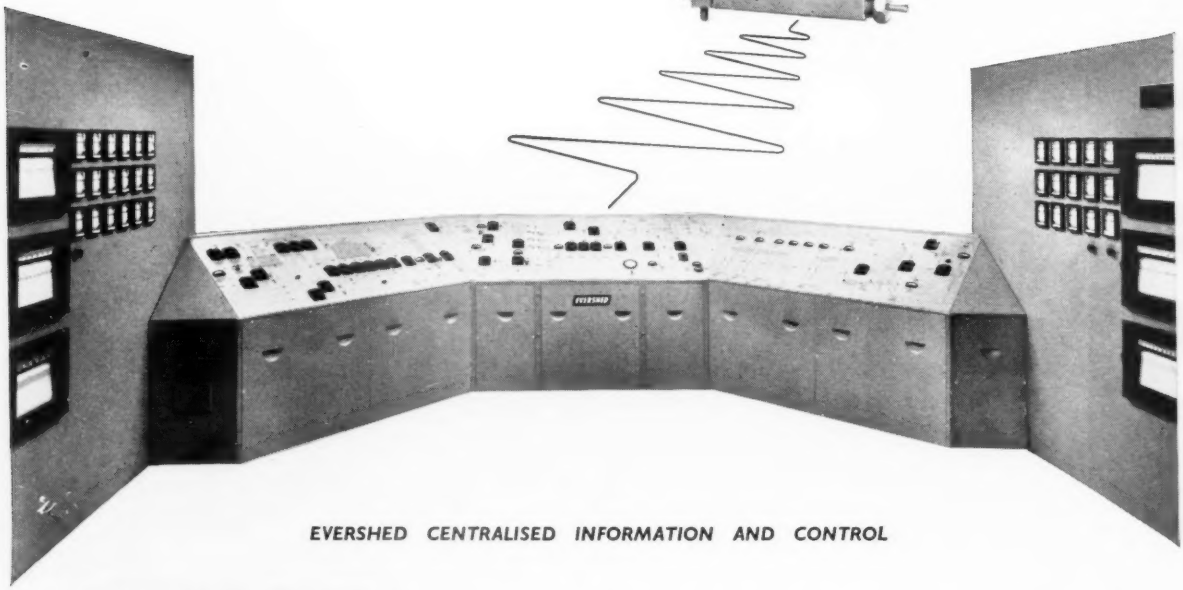

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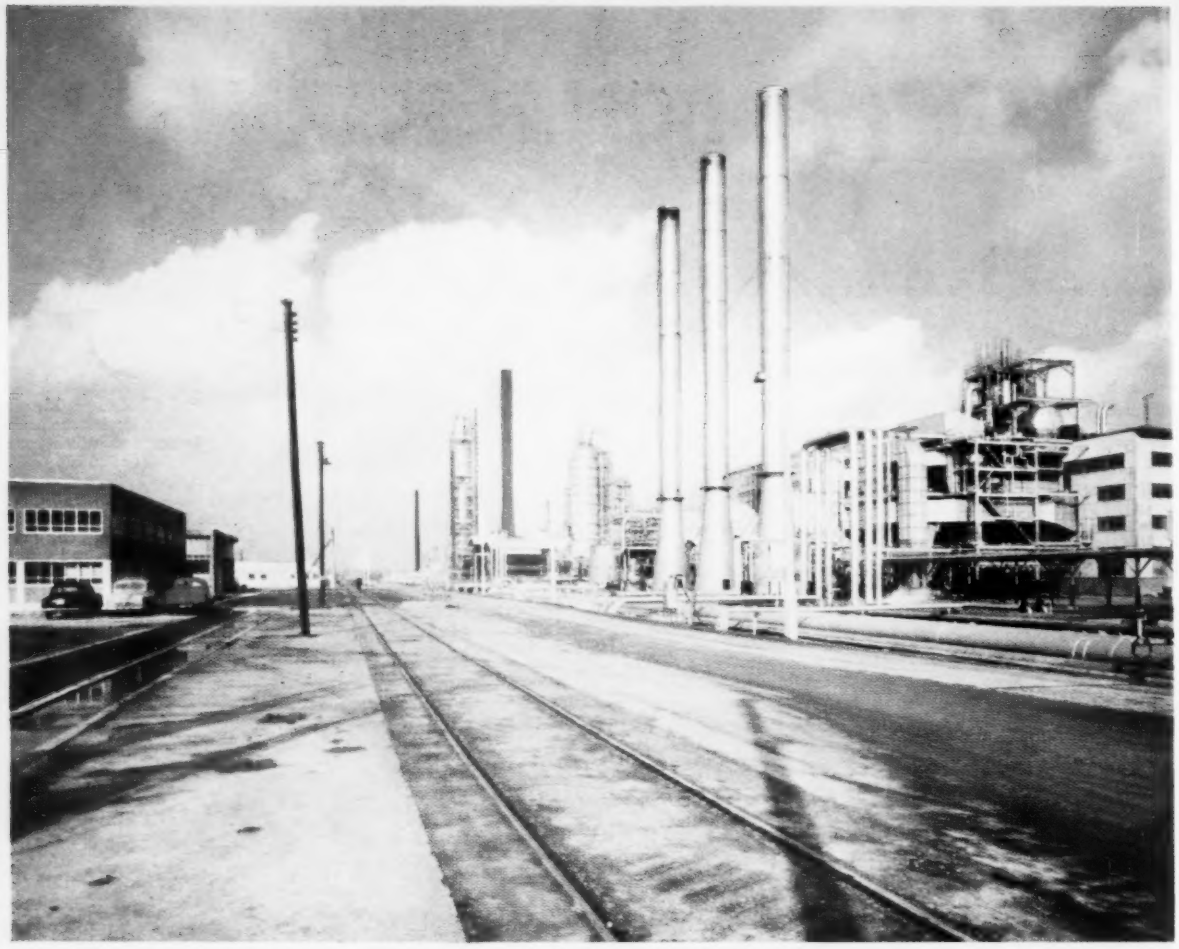

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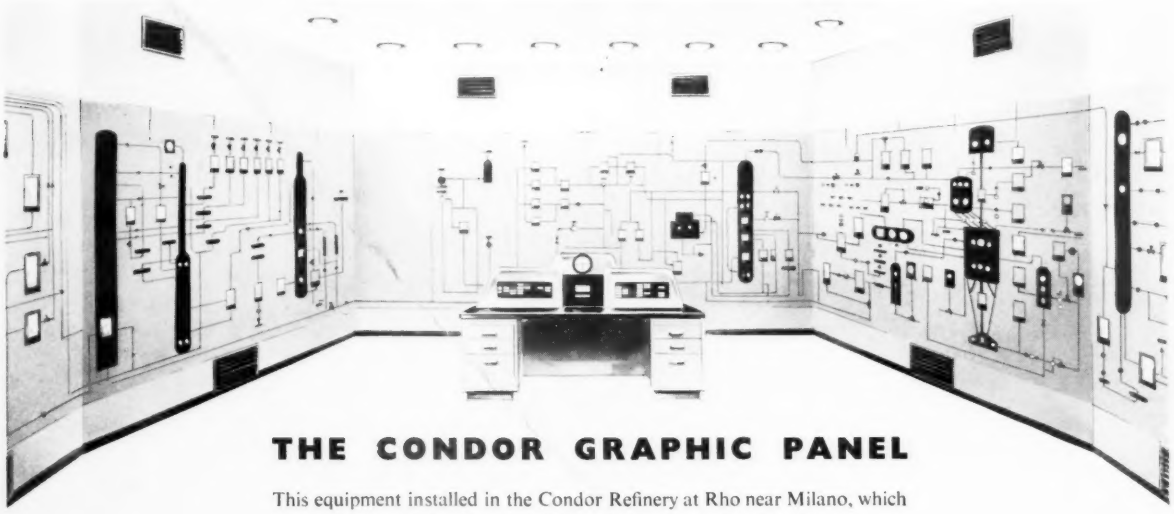

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